United States Court of Appeals
for the
District of Columbia Circuit

TRANSCRIPT OF RECORD

#105

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United States Court of Appeals for the District of Columbia

OCTOBER TERM, 1938.

No. 7280 377

EDWARD J. ABBOTT AND ABBOTT MACHINE COMPANY, APPELLANTS,

vs.

CONWAY P. COE, AS HE IS COMMISSIONER OF PATENTS OF THE UNITED STATES OF AMERICA.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA.

FILED NOVEMBER 10, 1938

PRINTED JANUARY 13, 1939

United States Court of Appeals for the District of Columbia

OCTOBER TERM, 1938.

No. 7280

EDWARD J. ABBOTT AND ABBOTT MACHINE COMPANY, APPELLANTS,

vs.

CONWAY P. COE, AS HE IS COMMISSIONER OF PATENTS OF THE UNITED STATES OF AMERICA, APPELLEE.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA.

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United States Court of Appeals for the District of Columbia

A. In the District Court of the United States for the District of Columbia

No. 60495 In Equity

EDWARD J. ABBOTT AND ABBOTT MACHINE COMPANY, *Plaintiffs,*

vs.

CONWAY P. COE, as he is Commissioner of Patents of the United States of America, *Defendant.*

UNITED STATES OF AMERICA,
District of Columbia. ss:

BE IT REMEMBERED, That in the District Court of the United States for the District of Columbia, at the City of Washington, in said District, at the times hereinafter mentioned, the following papers were filed and proceedings had, in the above-entitled cause, to wit:—

1 Filed January 20 1936

In the Supreme Court for the District of Columbia

No. 60495 In Equity

EDWARD J. ABBOTT, Wilton, New Hampshire, and ABBOTT MACHINE COMPANY, Wilton, New Hampshire *Plaintiffs*

v.

CONWAY P. COE, as he is Commissioner of Patents of the United States of America, *Defendant.*

Bill of Complaint to Compel Issuance of Letters Patent

To the Honorable the Judges of the Supreme Court for the District of Columbia.

Now come Edward J. Abbott and Abbott Machine Company bringing this their Bill of Complaint against Conway P. Coe, as he is Commissioner of Patents of the United

States of America, having his official residence in the District of Columbia.

1. Edward J. Abbott is a citizen of the United States of America, residing in Wilton, in the County of Hillsboro and State of New Hampshire; Abbott Machine Company is a corporation duly organized and existing under the laws of the State of New Hampshire with its usual place of business in Wilton, in said County of Hillsboro and said State of New Hampshire. The Defendant, Conway P. Coe, as he is Commissioner of Patents of the United States of America, has his official residence in the District of Columbia.

2. This is a Bill of Complaint brought under and pursuant to the provisions of the United States Code
2 Title 35, Section 63, as amended [Section 4915 of the Revised Statutes (Comp. Stat. Sec. 9460) as amended March 2, 1927 (44 Stat. L. 1335)].

3. Said Edward J. Abbott is the first, sole and original inventor of "Winding Machine", not known to or used by others in the United States of America before his invention thereof; not patented nor described in any printed publication prior to his invention thereof or more than two years prior to his application for United States Letters Patent therefor hereinbelow mentioned; not in public use or on sale in the United States of America more than two years prior to his said application; not abandoned, and for which no application for patent in any foreign country has been filed more than one year prior to said application for United States Letters Patent; on the 2nd day of January, 1931 said Edward J. Abbott signed a good and sufficient application for United States Letters Patent for said invention, and on the 5th day of January, 1931 filed said application according to law with the Commissioner of Patents of the United States of America, said application receiving the Serial No. 506,530. The Plaintiffs hereby make profert of a certified copy of the application as filed.

4. Said Edward J. Abbott on the 1st day of April, 1931 executed, acknowledged and delivered to Abbott Machine Company, an assignment in writing of all his right, title and interest in, to and under said invention for "Winding Machine" as set forth and described in said application Serial No. 506,530, said application, and any United States Letters Patent which might issue thereon. Said assign-

ment was recorded in the United States Patent Office on the 29th day of May, 1931 in Liber T148, page 428.

5. The said Edward J. Abbott in his said application
Serial No. 506,530 particularly pointed out and dis-
3 tinctly claimed the parts, improvements, combina-
tions and methods which he claimed as his invention
in and by certain claims, including claims Nos. 8, 9 and 10. Thereafter other proceedings were had in accordance with law and the rules of the Patent Office, and by letter to the Patent Office dated October 15, 1931 filed in said Patent Office October 16, 1931 certain new claims were added, including claims numbered 26, 28, 34, 35, and 36; thereafter by letter dated October 30, 1933, filed in the Patent Office October 31, 1933 said claim 26 was amended, and certain other claims numbered 37 and 38 were added; thereafter by letter dated July 27, 1934, received in the Patent Office July 30, 1934, said claim 26 was further amended. Said original claims 8, 9 and 10 and said added claims 26, as amended, 28, 34, 35, 36, 37 and 38 are in the following form:

8. A winding machine traverse device for laying a winding strand into layers of reversed spiral windings, including a rotary cylinder having a traversing groove therein, the goove including right and left hand spiral portions crossing each other at least once, said cylinder being of steel case-hardened in the region of the said groove.

9. A winding machine traverse device for laying a winding strand into layers of reversed spiral windings, including a rotary cylinder having a traversing groove therein, the groove including right and left hand spiral portions crossing each other at least once, said cylinder comprising an essentially solid bar of steel case-hardened in the region of said groove.

10. In a winding machine a traverse device for laying the winding strand into layers of reversed spiral windings, the traverse device including a rotary cylinder having a traversing groove therein, the groove including right and left hand spiral portions crossing each other at least once, the diameter of the cam being materially less than the width of the strand package wound, said cylinder comprising essentially a solid bar of steel case-hardened in the region of the said groove.

26. In a winding machine for yarn and the like, the combination of a traverse cam, a slider adapted to be traversed to and fro by the cam, a round guide rod on which the slider slides, the slider having a portion extending laterally of the guide rod in the direction of the winding mass of yarn and carrying a yarn-engaging element, and a cover plate for the cam disposed to contact with the said laterally extending portion of the slider adjacent to the yarn-engaging element.

28. In a winding machine for yarn and the like,
4 the combination of a cylindrical traverse cam, a slider
including a dog engageable with the cam surface of the cam to be traversed to and fro thereby, a round rod upon which the slider is adapted to slide, and a cover plate for the cam positioned to guide the slider as the latter is traversed.

34. A textile machine comprising a traverse cam, a tractor roll for driving the cam, and a resilient tire on the cam adapted to contact with the tractor roll.

35. A textile machine comprising a traverse cam, a tractor roll for driving the cam, and a tire on the cam adapted to contact with the tractor roll, said tire being formed of cork.

36. A textile machine comprising a traverse cam, a tractor roll for driving the cam, and a tire on the cam adapted to contact with the tractor roll, said tire being formed of rubber.

37. A winding machine traverse device including a traverse guide and a cam follower connected thereto, and a rotary cam adapted to reciprocate the follower, said cam having a groove in the form of connected right and left-hand spiral portions having the relatively steep pitch and rapid reversal of direction adapted for cross-winding traversing by said guide, said right and left-hand spiral portions crossing each other at least once, and the cam being of steel case-hardened in the region of the said groove.

38. A winding machine traverse device including a traverse guide and a cam follower connected thereto, and a rotary cam adapted to reciprocate the follower, said cam having a groove in the form of connected right and left-hand spiral portions having the relatively steep pitch and rapid reversal of direction adapted for cross-winding traversing by said guide, said right and left-hand spiral por-

tions crossing each other at least once, and the cam being an essentially solid bar of steel case-hardened in the region of the said groove.

Said claims hereinabove set out in full were finally rejected by the Primary Examiner under date of September 24, 1934. The plaintiffs hereby make profert of certified copies of letters to the Patent Office dated respectively October 15, 1931, October 30, 1933, and July 27, 1934 and of said Patent Office letter dated September 24, 1934.

6. The Plaintiffs, Edward J. Abbott and Abbott Machine Company, further aver that said claims as set out in full in Paragraph 5 of this Bill of Complaint state subject matter of patentable invention of which the Plaintiff,
5 Edward J. Abbott, is the first, sole and original inventor as alleged in Paragraph 3 of this Bill of Complaint, and which is and at all times has been patentable to said Edward J. Abbott or his assignee, Abbott Machine Company.

7. After the final rejection by the Primary Examiner of said claims as set out in full in Paragraph 5 hereof, the Plaintiff, Edward J. Abbott, in accordance with law and the rules and regulations of the Patent Office, appealed to the Board of Appeals of the United States Patent Office, assigning error by the Primary Examiner in rejecting said claims, and after hearing the said appeal, the Board of Appeals on August 2, 1935 affirmed the said rejection and decision of the Primary Examiner.

8. The said Plaintiffs, Edward J. Abbott and Abbott Machine Company, did not appeal from said decision of the Board of Appeals to the Court of Customs and Patent Appeals as provided for by United States Code Title 35, Section 59^a, but have elected and do elect to proceed under said Code Title 35, Section 63, as amended.

9. The Plaintiffs further aver that the Commissioner of Patents has refused and still refuses to grant Letters Patent for the invention defined by said claims 8, 9, 10, 26, 28, 34, 35, 36, 37 and 38 though the Plaintiff, Abbott Machine Company, as it here avers, is lawfully entitled thereto and is the sole and exclusive owner of all right, title and interest therein.

10. The Plaintiffs aver that the invention set forth and defined in and by said claims 8, 9, 10, 26, 28, 34, 35, 36, 37

and 38 was and is patentable to said Edward J. Abbott or his assignee, Abbott Machine Company; that the Board of Appeals erred in its judgment, and the Plaintiffs pray this Honorable Court to adjudge that the Plaintiff, Edward J. Abbott, or his assignee, Abbott Machine Company,
6 is entitled, according to law, to secure a patent for the said invention as specified in said claims, or for any part thereof, as the facts in the case may appear, and pray for such other and further relief as may appear to this Court to be meet.

11. And the plaintiffs pray that a *subpoena ad respondendum* directed to the Hon. Conway P. Coe, as he is Commissioner of Patents of the United States, be issued out of and under the seal of this Honorable Court, requiring him to appear and answer unto this Bill of Complaint, and to do and to receive whatsoever this Court may order in the premises.

EDWARD J. ABBOTT

and

ABBOTT MACHINE COMPANY

By EDWARD J. ABBOTT
Its President

State of New Hampshire
County of Hillsboro ss:

On this 15th day of January, 1936, personally appeared Edward J. Abbott, personally known to me, and made oath that he is one of the Plaintiffs named in the foregoing Bill of Complaint; that he has read the same and knows the contents thereof and that the statements therein contained are true of his own knowledge except in so far as they have been stated on information and belief, and that as to those he believes them to be true, before me

ELSIE I. GAGE
(Seal) *Notary Public*

State of New Hampshire
County of Hillsboro ss:

On this 15th day of January, 1936, personally appeared Edward J. Abbott, personally known to me, and made oath that he is the President of Abbott Machine Company, one of the Plaintiffs named in the foregoing Bill of Complaint; that he has read the same and knows the contents 7 thereof and that the statements therein contained are true of his own knowledge except in so far as they have been stated on information and belief, and that as to those he believes them to be true, before me

ELSIE I. GAGE
(Seal) *Notary Public*

ROBERTS, CUSHMAN & WOODBERRY
Attorneys for Plaintiffs

CUSHMAN, DARBY & CUSHMAN

By CUSHMAN DARBY & CUSHMAN
Solicitors for Plaintiff

Messrs. Cushman, Darby & Cushman
American Security Building
Washington, D. C.

Service acknowledged the day of January, 1936.

....
Counsel for Conway P. Coe
Commissioner of Patents

---

8 *Answer to the Bill of Complaint.*

Filed January 28 1936

* * *

To the Honorable
The Judges of the Supreme Court
of the District of Columbia.

Conway P. Coe, Commissioner of Patents, defendant, is absent from the District of Columbia and in his absence Richard Spencer, Acting Commissioner, in answer to the Bill of Complaint alleges on information and belief as follows:

1. He admits the allegations of the citizenship and residence of the plaintiff Edward J. Abbott, and the organization and principal place of business of the plaintiff Abbott Machine Company. He also admits the allegations as to defendant's official position and official residence.

2. He admits the allegation of jurisdiction under Section 4915 R. S. (35 U. S. C. A. 63, as amended.)

3. He admits that the plaintiff Edward J. Abbott filed an application for patent on a Winding Machine, on January
5, 1931, which application was given Serial No. 506,-
9 530, and that he made therein averments corre-
sponding to the allegations of paragraph 3 of the Bill,
but denies that such allegations are sufficient to justify the granting of a patent to plaintiffs including claims 8, 9, 10, 26, 28, 34, 35, 36, 37 and 38, which appear in paragraph 5 of the Bill.

4. He admits the allegations of assignment.

5. He admits the allegations as to the presentation of certain claims and the final rejection by the primary examiner of Claims 8, 9, 10, 26, 28 and 34 to 38, inclusive.

6. He denies that said claims 8, 9, 10, 26, 28, and 34 to 38, inclusive, are patentable to the plaintiffs since these claims are held to be unpatentable in view of the prior art and for the reasons given in the statement of the examiner in answer to the appeal and the decision of the Board of Appeals, copies of which will be presented at the trial:

Foster,	459,039	Sept. 8, 1891.
Rhodes,	867,153	Sept. 24, 1907.
Abbott et al.,	1,700,425	Jan. 29, 1929.
Voigt, British,	2,102	March 23, 1901.
Jones, British,	108,407	Aug. 9, 1917.

Profert of copies of these patents is hereby made.

7. He admits that an appeal was taken from the decision of the primary examiner rejecting claims 8, 9, 10, 26, 28 and 34 to 38, inclusive, and that the action of the examiner was affirmed by the Board of Appeals of the Patent Office.

8. He admits that plaintiffs did not appeal from the decision of the Board of Appeals to the United States Court of Customs and Patent Appeals.

9. He admits that he has refused and still refuses to grant a patent to plaintiffs including claims 8, 9, 10, 26, 28 and 34 to 38 inclusive, but denies that plaintiffs are lawfully entitled thereto.

10 WHEREFORE defendant having fully answered
the Bill of Complaint denies that plaintiffs are entitled to the relief demanded or any part thereof and prays

that the Bill be dismissed with all costs of the proceedings against the plaintiffs as provided in Section 4915 R. S.

RICHARD SPENCER
Acting Commissioner of Patents.

R. F. WHITEHEAD
Solicitor of the U. S. Patent Office,
Attorney for Defendant.

District of Columbia: *ss:*

I, Richard Spencer, depose and say that Conway P. Coe, Commissioner of Patents, is absent from the District of Columbia and in his absence I am Acting Commissioner; that I have read the above answer by me subscribed and know the contents thereof; that the statements of facts therein made as upon personal knowledge are true; and that those made upon information and belief I believe to be true.

RICHARD SPENCER
Acting Commissioner

Subscribed and sworn to before me this 27th day of January, 1936.

ALICE M. KENNEDY
Notary Public, D. C.

My commission expires October 15, 1940.

11 *Memorandum of Decision.*

Filed July 11 1938

* * *

I agree with the Board of Appeals of the Patent Office in this case in holding that there was no invention in having the cam case hardened, nor in the method of mounting the slider element.

I think that claim No. 34 was anticipated by the earlier Abbott and Abbott patent.

I see no invention in substituting a rubber or cork tire for a soft metal tire, in view of the known characteristics of the materials.

The bill should be dismissed with costs.

BAILEY, *J.*

---

12 *Findings of Fact*

Filed October 4 1938

* * *

1. This is a suit brought under the provisions of Section 4915 R. S. (U. S. C., Title 35, Sec. 63) which involves the application of Edward J. Abbott, No. 506,530, filed January 5, 1931, assigned to the Plaintiff Abbott Machine Company.

2. The application of Edward J. Abbott involved herein relates to winding machines of the type shown in the patent to Abbott and Abbott No. 1,700,425, issued January 29, 1929. The claims of said application which are involved in this suit are claims Nos. 8, 9, 10, 26, 28, 34, 35, 36, 37, and 38. Of these, claims 8, 9, 10, 37, and 38 relate to the case hardening of the cam, claims 26 and 28 relate to the slider element and its mounting, and claims 34, 35 and 36 relate to the tire on the cam which is adapted to contact with the tractor roll, claim 34 specifying that the tire is resilient, claim 35 that it is formed of cork, and claim 36 that it is formed of rubber.

3. The Abbott et al patent No. 1,700,425, discloses a wind-
ing machine of the "race course" type in which the
13 winding mechanisms are moved in a substantially
elliptical path and each of the winding mechanisms
contains a rotatable cam which has therein tires of soft metal which contact with a driving roll at each side of the machine. The cam is provided with an endless cam groove which crosses itself at least once. A slider is provided which fits into the groove of the cam and is thus caused to reciprocate back and forth so as to lay the yarn properly as it is being wound.

4. The machine of the Abbott et al patent No. 1,700,425 was capable of a speed of less than 400 picks per minute; a speed of 400 picks per minute corresponding to a winding speed of 200 to 250 yards per minute had been the accepted speed for thirty years on the Foster type stationary ma-

chines which has preceded the Abbott machine of said patent. The Foster machines are illustrated in patent No. 716,923 and have large cam cylinders with a single groove. A speed of 250 yards per minute is not enough to cause appreciable wear in the parts.

5. The factors that limited the speed of the prior machines were the throwing of oil on the yarn being wound and the breakage of sliders. Slider breakage was conceived to be due to shock at the point of reversal of movement and various attempts have been made to prevent it, as shown in patents No. 499,668 (buffers at ends of stroke) and No. 655,616 (light slider). Attempts were made to eliminate the soiling of the yarn by thrown oil in patent No. 585,198, (deepened cam groove and intermediate drive roll); No. 655, 617 (change in drive connections) and British patent No. 2102 of 1901 (enclosing cam cylinder). None of these machines could operate faster in winding than 250 yards per minute.

6. The operative speed of the Abbott machine shown in the above patent No. 1,700,425 was increased from less than
250 yards per minute to 750 yards per minute,—such
14 increase being made possible by three changes—the
case hardened steel cams, the specific slider construction, and the resilient tires.

7. The case hardened steel cams eliminated slider breakage which was found by the applicant to be due at speeds higher than 250 yards per minute to crumbling of the frog points on impact and the consequent lengthening of the gap across which the slider had to jump. Applicant found that slider breakage was not due to the shock on reversal of movement.

8. The case hardened steel cams also make possible speeds higher than 250 yards per minute with the use of smaller amounts of oil than could be used with the former machines, thus avoiding fouling of the yarn by thrown oil.

9. The slider construction made high speed possible without chattering or binding of the slider.

10. The tires of resilient material made possible high speed, rotation of the cam cylinders without slip between the cams and the long roll which drove them by frictional contact with the tires.

11. Over 300 winding machines have been built incorporating the devices of the claims in suit. In 1937 the Abbott Machine Company sold about 25% of the total number of such winding machines sold.

12. The Foster Machine Company has changed its stationary machine after the Abbott invention, discarding the large cam cylinders with the single groove and substituting therefor small case hardened steel cams with crossed grooves.

13. It has long been known that the wear resistance of a metal can be increased by a process of case-hardening. Examples of such hardening are shown in the Patents to Muller No. 1,551,764 and Birkigt No. 1,938,566. The former shows a power transmission chain in which the bearing faces of the links have been case-hardened. The latter shows a piston and cylinder in which the contacting faces have been case-hardened and in the specification of that patent it is stated that the combination of two surface-hardened frictional surfaces permits high speed operation and reduces friction and wear.

14. The United States patents to Foster Nos. 459,039 and 473,417 and 499,668 show cams in winding machines provided with crossed grooves therein adapted to cause proper movement of a thread guide. All the machines however are slow speed machines. The Rhoades patent No. 867,153 shows a ball wrapper which necessarily runs quite slowly possibly winding 100 yards per minute. The British patent to Jones No. 108,407 shows a spooling machine, which does not have a quick traverse motion of the thread guide and is a slow speed machine running at a speed varying from 50 yards per minute when the package is first started to several hundred yards per minute near the end of the winding operation.

15. The Foster patent No. 459,039 shows the slider element mounted on two round rods. Such a slider could not be run faster than 400 picks per minute (corresponding to a winding speed of from 200 to 250 yards per minute). In practice such a construction embodying two round rods would jam in use.

16. The Rhoades patent No. 867,153 shows the slider element mounted on one round rod. It is prevented from rotating on the round rod by an extension in back and

slider dog in front. At the time of the applicant's claimed invention, machines such as shown in the Rhoades patent
were run at speeds of about 50 to 60 yards per min-
16 ute. The slider of the Rhoades patent is so heavy
that it could not be run at speeds such as employed
in winders.

17. The British patent to Voigt No. 2102 shows a T-shaped slider running in two slots in the casing which are at right angles to each other. The slider is not mounted on a rod but is supported directly in the slots. This slider could not be operated at speeds greater than 400 picks per minute because it would jam badly.

18. The patent to Rowley No. 72,087 and the patent to Stevens No. 1,566,704 each shows a friction drive with the contact member on the driven element made of rubber. There is no maintenance in either patent of a frictional driving connection between the driven member and the driving member while one member is moving endwise relative to the other.

Conclusions of Law

1. It is not invention, in view of the prior art, to case-harden a cam for a winding machine such as shown in the Abbott et al patent.

2. It was not invention to mount the slider of such a winding machine in the manner specified in claims 26 and 28 of the Abbott application in suit.

3. Claim 34 of said application is anticipated by the Abbott and Abbott patent.

4. It was not invention to substitute for the soft metal tire on the cam shown in the Abbott and Abbott patent a
tire made of rubber or cork.
17 5. Plaintiffs are not entitled to a patent on the
Abbott application involved in this suit containing
claims 8, 9, 10, 26, 28, 34, 35, 36, 37 and 38.

6. The Bill of Complaint should be dismissed.

JENNINGS BAILEY
Justice

18 *Final Decree.*

Filed October 4 1938

* * *

This cause having come on to be heard and having been tried in open court and argued by counsel for the respective parties upon the pleadings and proofs adduced and submitted to the Court,

It is ADJUDGED, ORDERED and DECREED this 4th day of October, 1938, that the Bill of Complaint in this case be, and the same hereby is dismissed with costs against the plaintiff.

JENNINGS BAILEY
Justice

Approved as to Form:

ARLON V. CUSHMAN
Attorney for Plaintiffs.

From the foregoing decree the plaintiffs, Edward J. Abbott and the Abbott Machine Company, in open court on the date named above, note an appeal to the United States Court of Appeals for the District of Columbia, and the Court fixes the cost bond on said appeal in the sum of $100, or in lieu thereof the sum of $50 in cash to be deposited with the Clerk of this Court.

JENNINGS BAILEY
Justice

19 *Notice of Appeal*

Filed October 5 1938

* * *

Notice is hereby given this 5th day of October 1938, that Edward J. Abbott and Abbott Machine Company hereby appeal to the United States Court of Appeals for the District of Columbia from the judgment of this Court entered on the 4th day of October, 1938, in favor of Conway P. Coe against said Edward J. Abbott and Abbott Machine Company.

ARLON V. CUSHMAN
Attorney for Edward J. Abbott
and Abbott Machine Company

Memorandum

OCTOBER 7-1938.

$50 deposit in lieu of bond on appeal.

20

Stipulation

Filed October 13 1938

* * *

It is hereby stipulated by and between the parties to the above-entitled cause that Plaintiffs' Exhibits Nos. 3 to 14 inclusive, which are not susceptible of being reproduced in the Transcript of Record, may be transmitted to the United States Court of Appeals for the District of Columbia to be there used as physical Exhibits.

EDWARD J. ABBOTT
ABBOTT MACHINE COMPANY
By ROBERTS, CUSHMAN & WOODBERRY
Their Attorneys

CONWAY P. COE
By R. F. WHITEHEAD
His Attorney

21

Order

Filed October 13 1938

* * *

It is Ordered this 13″ day of October, 1938, that Plaintiffs Exhibits 3 to 14, which are not capable of reproduction in the record, be transmitted to the Court of Appeals of the District of Columbia in the custody of the Solicitor for Plaintiffs-Appellants.

O R LUHRING—
Justice.

We consent to the entry of the above Order.

ROBERTS, CUSHMAN & WOODBERRY
Attorneys for Plaintiffs-Appellants

R. F. WHITEHEAD
Attorney for Defendant-Appellee

ARLON V. CUSHMAN
Solicitor for Plaintiffs-Appellants

R. F. WHITEHEAD
Solicitor for Defendant-Appellee

22 *Stipulation as to Record*

Filed October 13 1938

* * *

Now come EDWARD J. ABBOTT and ABBOTT MACHINE COMPANY, the Plaintiffs-Appellants, and CONWAY P. COE, Defendant-Appellee, and designate the following parts of the record proceedings and evidence to be included in the record on appeal:

1. Bill of Complaint
2. Answer
3. Memorandum of Decision
4. Findings of Fact and Conclusions of Law in the District Court of the United States for the District of Columbia
5. Final Decree of October 4, 1938
6. Notice of Appeal
7. Order Fixing Bond or Cash Deposit in Lieu Thereof (appended to the foot of the Decree)
8. Memorandum of Deposit of $50.00 in lieu of undertaking on appeal
9. Statement of Evidence
10. The following Exhibits: Plaintiffs' Exhibits Nos. 1, 1^a and 2, and the following documents from Defendant's Exhibit No. 1: United States Letters Patent Nos. 1,551,764; 1,938,566; 72,087; 1,566,704; Examiner's Statement; and Decision of the Board of Appeals; said Exhibits being attached to and made a part of the Statement of Evidence
11. Stipulation and Order as to Plaintiffs' Exhibits 3 to 14 inclusive. 23
12. Stipulation as to Record.

ROBERTS, CUSHMAN & WOODBERRY
Attorneys for Plaintiffs-Appellants

R. F. WHITEHEAD
Attorney for Defendant-Appellee

ARLON V. CUSHMAN
Solicitor for Plaintiffs-Appellants

R F WHITEHEAD
Solicitor for Defendant-Appellee

24 District Court of the United States for the District of Columbia

UNITED STATES OF AMERICA,
District of Columbia, ss:

I, Charles E. Stewart, Clerk of the District Court of the United States for the District of Columbia, hereby certify the foregoing pages numbered from 1 to 23, both inclusive, to be a true and correct transcript of the record according to directions of counsel herein filed, copy of which is made part of this transcript in cause No. 60495 in Equity, wherein Edward J. Abbott and Abbott Machine Company are Plaintiffs, and Conway P. Coe, as he is Commissioner of Patents of the United States of America, is Defendant, as the same remains upon the files and of record in said Court.

In Testimony Whereof, I hereunto subscribe my name and affix the seal of said Court, at the City of Washington, in said District, this 24th day of October, 1938.

C. E. STEWART,
(Seal) *Clerk.*

25 In the District Court of the United States For the District of Columbia

In Equity

No. 60495

EDWARD J. ABBOTT and ABBOTT MACHINE COMPANY, *Plaintiffs*

v.

CONWAY P. COE, Commissioner of Patents, *Defendant*

Statement of Evidence

On the hearing of this cause, evidence in behalf of the respective parties, Plaintiffs and Defendant, was offered and given as hereinafter stated, as follows:

Plaintiffs' counsel offered in evidence the following exhibits:

No. 1 Certified copy of application Serial No. 506,530
No. 1^a Certified copy of original application drawings
No. 2 Bound volume of copies of sundry patents:

U.S. Patents:
459,039
473,147
499,668
585,198
655,617
716,923
952,015
867,153
1,950,990
1,700,425
655,616

British Patents:
2102
108,407

Edward J. Abbott

Edward J. Abbott, a witness called on behalf of the Plaintiffs, being duly sworn, did testify as follows:

Direct Examination:

My name is Edward J. Abbott and I reside in Wilton, New Hampshire. I am a machinery and textile manufacturer connected with the Hillsboro Mills, worsted, spinning, and dyeing plant; the Abbott Worsted Company,
26 which weaves fine and fancy men's wear goods; and the Abbott Machine Company, manufacturers of textile machinery. The Hillsboro Mills takes the raw wool, scours it, combs it into worsted top, dyes it, spins it into yarn; the Abbott Worsted Company weaves it into fabrics and finishes the fabrics; and the Abbott Machine Company sells textile machinery. I am the president of the Hillsboro Mills and the Abbott Machine Company. (R. p. 31)

I am the applicant of the application involved in this case, Serial No. 506,530, filed January 5, 1931. At the time I made this invention there were commercial winding machines that had a constant winding speed that wound headless cheeses and employed a slider. The largest maker of those commercial machines was the Foster Machine Company of Westfield, Massachusetts. The Universal Winding Company made a very similar machine but not in equal volume. (R. pp. 31-32)

The winder of the Foster Machine Company is illustrated in patent No. 716,923. It has its packages supported on a spindle, which rests on a main tractor roll, No. 46, outlined in blue on Fig. 1. Those tractor rolls ran commercially about 1,000 to 1,200 revolutions a minute, and they were generally made two inches in diameter and gave a winding speed of about 200 yards a minute. With the ordinary ratio of winding, of traverse speed to winding speed, there would be not over 400 picks per minute. Then, as shown in Fig. 2, there was a large cam, No. 11, as outlined in red, which ran 200 revolutions per minute, giving us 400 picks per minute. That cam had square grooves in it, in which there ran a single dog or slider of a boat shape. Those grooves did not cross each other. The cam was made large enough, 12 or 16 inches in diameter, so that the groove could be a single groove around it, without any crossings. I produce one of the typical Foster winding cams used in this type of machine about which I have just been testifying. (R. pp. 32-34)

27 (The Foster winding cam so produced and identified was offered by the Plaintiff and admitted Plaintiffs' Exhibit 3.) (R. p. 34)

There is more than one parallel groove in this winding cam. The center groove is to wind a headless cheese and it has a uniform advance for each angle of rotative motion. The two outside grooves are to wind cones and are distorted so as to move the traverse eye or slider. It moved the guide of the arm a little faster near the tip than at the base, which formed a better cone. Since they use the same cam to operate both sides of the machine, they had to have a different shaped groove in it for each side, where it was distorted, so that the two outside grooves are those distorted ones and the middle groove could be used on both sides to wind the cheese. They employed a traverse guide or a traverse eye, No. 136, Fig. 1. I produce one of the commercially used ones about which I have just been testifying. (R. pp. 34-35)

(The traverse guide so produced and identified was offered by the Plaintiff and admitted as Plaintiffs' Exhibit 4.) (R. p. 35)

That slider was moved to and fro on the round rod and also on a square rod, to keep it from rotating (as shown in Figs. 1 and 2). In Fig. 1, here is a square bar 15 (indicating); and then here is a boat-shaped dog, which does not seem to be shown very plainly here, which has a stem, shown slightly in Fig. 1, in the slider, and that dog ran in this groove (indicating) and moved the slider to and fro. The cam, No. 11, illustrates a single groove cam, and the groove is shown as No. 12. This illustrates the kind of cam that is also represented with more grooves by Plaintiffs' Exhibit 3. Then they had springs, shown as No. 16, against which this slider struck at the end of its stroke, which were to prevent such a severe action on the reversal points. The dog was heavy and was sliding across there fairly fast; and when it came to the end of its stroke it was stopped abruptly

by the change in direction of the cam groove. This
28 gave a great strain on the parts, particularly the stem
of the little dog, so that the springs were inserted to give sort of a snubber or buffer action at the end of the stroke, to help eliminate the severe shock. As that cam cylinder 11 is rotated this dog slides in the groove and makes the slider go back and forth. (R. pp. 35-36)

The driving roll 46 drove the cheese or cone by surface contact, revolving it in a direction to wind the yarn. That panel just back of the roll 46 is this large cam which does the traversing action and is shown as No. 11 in the cross section on Fig. 2. There is very little of it shown. It shows part of it above the tractor roll 46, with a piece of groove, and then it shows down at the bottom, with another piece of groove, which is marked 12. The main body of it is hidden by the other parts. There are two rolls 46, one on each side of the machine, set up above and to the center, slightly, of the main cam. The center of the main cam was right in the center of the machine. The slider and its rods that it slid on were located as near the surface of the cam as they could be, to get a short stem on the dog and avoid all possible shock. On the other hand, the eye that guides the arm had to be in front, and up as close as possible to the nip between the driving rolls and the package, so that, while the main body of the slider was down near the cam surface, the neck of it had to be carried out and wrapped around the roll 46 to make a proper turn. (R. pp. 37-38)

On Fig. 1 the rolls 46 are shown as being driven by gearing from the main driving shaft. They illustrate some drive pulleys, Nos. 4 and 5; on the same shaft is a large gear, No. 34; and right in front of that gear on that view is illustrated a small gear, No. 36, which is mounted on the end of a shaft which carries through bearings and then through the roll 46 and through another bearing 39, and thence on down through the machine; on a commercial
machine through probably fifty such rolls and units.
29 Most winding machines are built with approximately
a hundred spindles, fifty spindles to a side. This one was a stationary machine. I have been familiar with winding machines since I went to take charge of the Hillsboro Mills in 1910. (R. p. 39)

This description I have just given of a stationary winding machine is a description of the commercial Foster machine as it existed about the time I was doing my development work. I purchased about six Foster machines for my own use in 1910 to 1912, in that period, and ran them for 15 years; and we still have one or two old ones we use occasionally. Their standard recommended speed was 200 revolutions a minute of the cam, giving 400 picks a minute. (R. pp. 39-40)

I refer to the second patent in the book (Plaintiffs' Exhibit 2)—patent No. 585,198—a patent of one J. W. Foster, assigned to the Foster Machine Company. That Foster Machine Company is the maker of those machines about which I have been talking. That machine, as illustrated on Fig. 3, had a single large cam, apparently about 16 or 18 inches in diameter, which had a single groove in it, the groove being continuous, without crossing itself. Then there was a dog, shown as A^2, which ran in this groove and is best shown in Fig. 4. This was a groove set down from the surface, in which the dog ran, and the slider, in this case A^{20}, was arranged to slide on a round rod or rectangular rod, and was driven by the action of this groove and the cam through the dog to the slider, to make it traverse on the rod. That made the slider carrying the thread go back and forth. The package was illustrated to be driven in one of two ways. The aspect shown in Fig. 1 has a roller S, which sets in open bearings, so as to rest by its weight against the outside surface of the cam A^2. Then, on top of that roll S there was placed a cheese, illustrated as T^4 in Fig. 1, shown in dotted lines. They did not illustrate how that particular package was to be supported. Apparently by the conventional package arms. The cam A^2 then rotated and in turn revolved the roll S and that, in turn, rotated the package T^4. At the same time this groove rotated this traverse guide A^{20}, to traverse the yarn to and fro and wind it on the package in the typical cross-wound construction. (R. pp. 40-42)

I refer to Fig. 4. That shows a groove. The purpose described was to keep the oil away from the package. They had some oil grooves in there to keep oil down inside the groove, and to try to keep it away from the surface of the cam and hence prevent it being carried up by roll S to the package T^4. If oil should get out of that deep groove in the cam cylinder, it would carry out on the surface of the cam and it would roll against the roll S and oil it and that, in turn, would carry the oil against the package. (R. p. 42)

I refer to Foster patent No. 655,617, which is, I believe, the fourth patent in the book (Plaintiffs' Exhibit 2). That is a machine with a main central shaft on which cams of this large type marked A^2 are mounted. They had these rectangular shaped grooves, indicated as A^3, which was a single groove not crossing itself, coming back to the point of beginning of the one complete circuit. Those cams were arranged to serve both sides of the machine and to move traverse guides 4 to and fro on rod 5. (R. pp. 42-43)

There was a package roll M, or, rather, two of them, one on each side of the machine, which were driven by shafting and belts in this case, the pulley F^6, up through the belt F^5, to the pulley F^4; and that shaft was designed to pass along the length of the machine and supported the rollers M, and then the cones illustrated in this case were allowed to rest on these rollers by gravity, being supported out by arms D. These rollers M, shown in this Foster patent No. 655,617, differ widely in construction from the rolls S shown in Foster patent No. 585,198. In 655,617 the rollers were
31 driven by an independent means instead of being
driven from the surface of the cam. The roll S was driven from the surface of the cam in the Foster patent No. 585,198. In the Foster patent No. 655,617 that same roll was driven independently. The greatest purpose of this independent drive was to enable the roll to be shielded from the cam, so that oil could not be spattered or rolled onto it. It does not roll on the surface of the cam, so it cannot pick up any oil that way from it; and, in turn, it cannot pass any oil up against the packages themselves. (R. pp. 43-44)

I refer to Foster patent No. 459,039 which was cited by the Patent Office in prosecution of this case. That was evidently quite a slow speed machine, since it illustrates taking the yarn by revolving a bobbin which is mounted on the framework in Fig. 1, at the top of the winder. The modern winders all take the yarn off the bobbins over end at very high speeds. It differed from the Foster winders which we have been examining so far in that the spindles of the packages and the axis of the shaft which supports the cams were set at right angles to the length of the machine, so that there were no long rolls going down the machine. The rolls were short. The cam in this case, instead of being mounted on a shaft which ran the whole length of the machine, was mounted on a cross shaft driven by a quarter-turn belt. That cross shaft is marked e^1 and is surrounded with a red circle in Fig. 1 of the patent. (R. p. 44)

We have a cam cylinder h shown by itself in Fig. 5. This cam had what is illustrated as a rectangular shaped groove and was a groove that wrapped around the cam twice, so that it crossed itself at one point. I am not sure of the purpose of those cross grooves: I imagine it was to make the cam smaller. It is not described in this patent, but I should judge the purpose of making the cam smaller was to
32 enable it to be mounted on a drum or cylinder e. Apparently it is mounted very loosely on this drum, hanging on it, so to speak, and is rotated by it by friction on its inside surface from the outside surface of the drum e. That is, as I understand it, this cam cylinder h^1 is hollow and has a pulley inside that is slightly smaller in diameter than the inside diameter of the cam cylinder, so that apparently it can run on there loosely. This drum e is mounted on shaft e^1, which is driven by the main power source. Then the hollow tube or cam cylinder h is evidently slipped on that, riding on it by its own weight; and when the pulleys or drums e revolve they revolve this outside cylinder. The purpose of having this inside pulley e which drove the cam cylinder h smaller than the inside diameter of h, was evidently to apply a brake to the bottom of the cam h and lift it up and stop its rotation and at the same time let the drums e continue to revolve. That is, if you wanted to stop the cam cylinder h' all you had to do was to jack it up or raise it up into contact with this pulley e and ultimately the cam cylinder h would stop turning. (R. pp. 44-46)

They have the package itself, in one phase of one description, running directly on the surface of the cam h, as shown in Fig. 8. Then in Figs. 3 and 4 they show the small intermediate rolls g and g^1, which were apparently driven by friction by the main cam cylinder and, in turn, rotate the package by friction. The purpose in having the cam cylinder h small has a relation to the method they had of driving and stopping the cam cylinder. I imagine if the cam cylinder were made large enough to be a single groove cam, it would be twice that diameter. Then it would wabble around badly and would be heavier for the brake to work on, and I should think it would have been very difficult to keep it in correct alignment with the center of winding. It would tend to get cross-ways on these pulleys *e*. (R. pp. 46-47)

33 I have never seen a machine like the one shown in that Foster patent No. 459,039. I have never seen a Foster machine with cross grooves in the cam cylinder prior to my invention. (R. p. 47)

The Foster commercial machine ran 400 picks per minute. In my opinion it could not have been driven any faster. I tried it myself quite a few times and immediately the dogs which rolled the sliders would break. When I say "the dog" I mean this little shoe or boat that fits down in the groove;—the round stem of it would break away from the boat-shaped part. There would have been other objections or difficulties in running these Foster machines faster than 400 picks a minute. There would come to be lubrication trouble. They were normally lubricated by putting a dab of grease in the groove; but at higher speeds that would have been thrown away by centrifugal force, and the lack of lubrication in the cast-iron groove would make it rough up and wear badly. The damage to that was never very severe in any that I have ever seen in my experience, because the crucial point was always passed first, due to breakage of the dogs or the whipping off of these goose necks. Any faster speed would have thrown grease on the intermediate driving roll, and from there it would have gotten on to the package which was being driven in contact with that intermediate roll. (R. pp. 47-48)

I have been talking about picks. The pick in this case is like the pick in the loom, just one movement across, and another second pick would be back again, that is, the movement across from one end of the cam cylinder to the other is one pick, and a movement back again would be the second pick. The number of picks per minute is the controlling factor in the production of any of these winding machines. In winding these packages you may wind three inches of yarn while you are moving across that face one inch, which would be a ratio of winding of 3 to 1. And on many
34 yarns, like heavy coarse yarns or worsted yarns, it is quite necessary to move that fast on the traverse

to get a well formed package. On cotton yarn you can have a ratio of, say, 4 to 1; that is you can rotate the circumference of the package four inches while the thread guide is moving the arm across the face of it one inch. For certain types of work, where the appearance of the package is not important and where the yarn holds together well, that ratio can be increased up to as much as 6 to 1. In other words, with the same number of picks per minute you can run through quite a range of winding speeds. Most winders are run with a ratio of 4 to 1. However, for any given job the ratio of winding speed to traverse speed is determined by the type of package and the material to be wound and then its production is limited by the speed that you can run the pick motion. The faster you can run the pick motion the higher winding speed can be obtained and the faster you can build up these packages. (R. pp. 48-49)

These Foster machines that I have been describing, both the commercial machines and the one referred to in the patent No. 459,039, would wind either cheeses or cones at a constant winding speed. They may be described as constant winding speed, headless cheese winders with sliders. These machines that wind a headless cheese at a constant winding speed, with a slider, constitute probably 30% to 50% of all winding machines. They are the big mass production type of machine. (R. pp. 49-50)

I refer to the Rhoades patent No. 867,153. That machine, from the description, would be known today as a ball warper. It was arranged to take a great many ends, probably 500 or approximately 1000 ends, without any twist in them, to combine in a rope form, and pass it through a trumpet cone, on Fig. 1, and to wind it on a large cross-wound ball, B, as shown in Figs. 1 and 2. Normally these balls were wound up about 3 or 4 feet in diameter, and today a standard width is 54 inches, 4½ feet. They would hold three or four hundred pounds of yarn. They are formed as a supply to big continuous dyeing machines or for bleaching, where the strands from a number of these balls are passed continuously through the dye kettles or bleaching kettles. Of necessity they run quite slowly, not only due to the limitations of the size of the package being wound, but they draw from either warping mills or other supplies of yarn which cannot supply them at a very high speed. I should judge the machines described by the invention, which was in 1907, were arranged to run about 50 yards a minute, possibly a hundred yards a minute. (R. p. 50)

The Foster commercial machines, such as I have been describing, run about 200 to 250 yards a minute. (R. pp. 50-51)

The package that is wound by this Rhoades machine is marked *b* in Fig. 2. It is formed up in this same type of formation as a cheese would be; but commercially it would be known as a ball. Its uses are entirely different from the uses to which headless cheeses are put. It is an entirely different thing; it is a large package used in the warping or dyeing machine, rather than being classified as a winder. The winder really does not operate on the yarn to change its shape or condition in any way. It merely passes it from one package and develops it into another package. Probably the greatest use of these winding machines is to wind yarn from small spinning bobbins, which hold generally three or four ounces of yarn, and wind it into large cheeses or cones, which hold about four pounds; and then these cones or cheeses are used for shipment between mills. They are used as large supply packages in warping and twisting creels. They are used for dye packages in some cases, when they are wound soft. (R. pp. 51-52)

Then just the reverse of that happens when yarn is wound on to a small bobbin to go into the shuttle of a
36 loom. Those bobbins hold two ounces for the most
part and the yarn is spun directly onto the filling bobbins that go into the loom. But in many cases, where the yarn is dyed or processed in other ways, it is finally wound onto the filling bobbins. In other words, you wind little bobbins onto big packages or big packages are broken into small bobbins. (R. p. 52)

Then there is a certain amount of winding from one large package to another; for example, from a cheese into a knitting cone. Very often after a yarn is dyed it has to be rewound to get it into better form or shape. (R. p. 52)

There is nothing done to the yarn itself in winding except they pass the yarn through some kind of a slub catcher which breaks it when a slub comes along. A slub is something that should not happen; it is a defect in the yarn. They are called "gouts". (R. p. 52)

The yarn is not processed really in winding. The work that is done there, other than passing it from one package to another, is chiefly on certain winding jobs to take out defects, which are usually enlarged parts of the yarn, and they are allowed to bump into the slub catchers, which break the yarn at that point, and then the operator ties the pieces together. They are also waxed at times, run under a piece of wax, to shine them up and make them slippery. Winding is done chiefly just to move it from one package to another; and then, in addition to moving it from one package to another, there is the advantage of detecting these slubs on the winding operation. They could not practically be detected in the loom. On the loom there are 2000 or 4000 threads in a warp; and if a slub should pass up from the beam and start towards the cloth, you would have to have somebody examining that all the time. In cotton mills one weaver will tend anywhere from 20 to 150 looms,
covering a tremendous area, and the inspection there
37 would cost a lot of money. It is a vastly simpler
plan to take the slubs out of the yarn when it is being wound, before it gets to the loom. One purpose of rewinding is to get the yarn from one package to another. (R. pp. 52-53)

I produce this headless cheese which is a form of package made on winding machines. (R. p. 53)

(The headless cheese so produced and identified was offered by the Plaintiff and admitted as Plaintiffs' Exhibit 5.) (R. p. 55)

That is known as a cheese, justly purely due to its form, resembling an ordinary cylindrical cheese; and its chief feature is that it has no heads on the core, but the heads are built up by the yarn itself, by crossing it rapidly this way (indicating), to and fro. When yarn is taken from it, it can be taken off very fast and the yarn can run faster and the winding thing that is taking it away can stop quickly without the package over-running. So, as the yarn is taken away from it and the package gets smaller, there are no heads, so that you have the same action there by which this thread can draw off until all the yarn is exhausted. It is also possible to wind much larger packages of this type than you can with spools, because spools would be expensive and the heads are troublesome and it would be hard to keep them true. (R. pp. 53-54)

This particular type of package is used largely as a supply of twisters, and two or three or four dozen threads are carried down to a big spindle and the yarn is twisted together. The package can be rotated and is the only thing rotated. It is used in the creels of warpers, where four or five hundred of these cheeses are placed and the yarn is drawn off over the end, through suitable tensions, and then arranged in a sheet and wound on a big warping beam with these four or five hundred ends abreast; and then they take four or five of them, enough to make up the number of ends in a loom beam. If they wanted 2500 ends in the
38 warp, for example, they would use six of the 400-end
beams and they would unwind from those together the whole 2000 or 2500 ends, through a slasher, in which they put on glue and size; and then that goes over big drying cylinders. (R. pp. 54-55)

The loom beam is set up back of a loom and feeds these thousands of ends, the warp ends, in a sheet forward through the loom and the cloth beam; and each one of these threads is manipulated by the harness and shuttles, lifting certain threads and lowering certain ones, and the filling yarn and the shuttle are then passed to and fro in that open shed, and as each pick is carried forward there is a reed which reaches forward and pulls the pick into the cloth. (R. p. 55)

These winders are used to produce the different kinds of packages that the spinner of yarn would like to have. Those different kinds of packages have different uses in the textile industry. Of those kinds of packages the so-called "headless cheese" is one that has various distinctive uses to which it can be put. (R. pp. 55-56)

I refer to the English patent to Jones No. 108,407. That machine was evidently arranged to wind onto a spool which has heads on it. The spools and heads are shown on Figs. 1 and 2, as No. 5. Then it has a traverse motion, which is mounted quite a ways from the spool; and, of course, you could do that in winding a small spool, because there is not a quick traverse. The movement is so small each time that the thread follows the traverse guide, even though it is quite a ways off. (R. p. 56)

The traverse motion in this Jones patent is an assembly of parts, shown in Fig. 2 to the best advantage. There is

a stationary rod 1, on which there is a pully 3, the hub of which is extended so that it could slide to and fro on No. 1. The yarn passes up over two small guides or rollers, No. 9, shown in Fig. 3, and around this pulley, which in Fig. 3 seems to be shown as No. 7. The yarn passing
39 around this pulley rotates it. Then they have on
the inside of that pulley a dog, which is shown in Figs. 5, 6 and 7 as No. 4, and this dog rotates with the pulley and carries around in a groove or a series of grooves that are cut in this rod 1; and this action slowly winds the pulley to and fro and so traverses or winds the yarn on this spoon, No. 5. It is the winding of the yarn on this spool that pulls the yarn through the device. (R. pp. 56-57)

The spool is rotated by some means which are not shown; and this rotation winds the yarn on it, pulls the yarn around that pulley and onto the spool. As the yarn is pulled around the pulley the pulley rotates, and just screws itself along the shaft 1 from one end to the other end and back again. (R. p. 57)

The shaft seems to be fixed; and yet it shows a gear 10 to rotate it slowly, that gear 10 being driven by a worm gear 11, so that it evidently goes quite slowly; and that not only—of course not only the rotation of the pulley that screws itself to and fro but also the rotation of the shaft itself, slowly. That arrangement is on there, as I understand the patent, not for definite movement while the machine is operating, but more to line it up so as to make this traverse motion center on the particular spool on which they are winding. (R. pp. 57-58)

The machine of the Jones patent winds a spool with heads. The winding speed varies on a machine like that, because the package is driven at a constant number of revolutions by the spindle. Of course as the package gets larger it winds faster. They generally start those spooling machines of that type (which are the ancient method of winding yarn)—they would start at perhaps 50 yards a minute and go up to several hundred yards a minute, when they are large. (R. p. 58)

The spool is quite a different package from a headless cheese. It is wound in a different way. It was a previous supply to warping creels and has been used as a shipping package and has been replaced almost entirely by headless cheeses. (R. p. 58)

40 I have referred to the Foster type of machine. That type of machine is made by people other than the Foster Machine Company. I referred to the Foster machine as winding a headless cheese. It will wind other packages such as the two I now produce. (R. pp. 60-61)

(The cones so produced and identified were offered by the Plaintiff and admitted as Plaintiffs' Exhibit 6 and Plaintiffs' Exhibit 7, respectively.) (R. p. 61)

The one there on a wooden core (Exhibit 6) is a slightly tapered cone, and is used largely for warping. Exhibit 7 is a cone wound on a paper core and is of considerably more taper, generally about 18 included degrees, and is used for knitting. The winding on those two packages (Plaintiffs' Exhibits 6 and 7) is the same as the winding of the cheese (Plaintiffs' Exhibit 5). These types of packages (Plaintiffs' Exhibits 5, 6 and 7) can be made also on the machine of the application involved in this suit. (R. pp. 61-62)

I have been familiar with machines that wound cheeses or cones like these Plaintiffs' Exhibits 5, 6 and 7 that have been put out from 1910 to the date of my invention. I have been in charge of a worsted spinning plant, where winders are used mostly, so that I have kept in touch with all the various machines which such a mill would need; and I have gone around to textile shows; have written manufacturers for catalogs; their salesmen have come to see me; I have visited a great many mills in the course of selling worsted yarn or engineering services, and I have examined their plants and checked the operation of their machinery of all kinds, winders particularly, because we were interested in making them. (R. p. 62)

The commercial top speed of such machines would be 400 picks per minute. There were many run at slower speeds and they might, of course, have been run at high speeds without my knowledge; but that seemed to be the accepted high speed to run that type of winder. During this period from 1910 to the date of my invention 400 picks per minute
was considered to be a maximum number for
41 these machines that I have been talking about. I
should judge that the reasons for this opinion were
both mechanical limitations, that the machines would not
run any faster without breaking, chiefly these dogs and
sliders; and there was also more or less a state of stasis

in the industry, where they thought that speed was all right; and, while the machinery builders were working for higher speeds, for the time being I should say the mills were content. They were more interested in developing uses for this form of package, putting on new tensions and spindles and a lot of other gadgets, which generally develop when a new machine comes on the market, and the development seemed to be there rather than in higher speed. If these machines were run faster than 400 picks per minute there would be inevitable lubrication troubles. The effort to put on more oil and grease for higher speeds would dirty the yarn. The bearings were not suitable to run at higher speeds. (R. pp. 62-64)

I have referred to the opinion of the industry as to maximum speed for these machines. There are quite a few references in the technical literature to this opinion. I refer to ‘‘The Principles of Worsted Spinning’’ by Howard Priestly, Longmans, Green & Company, 1921. It is a very standard book for worsted spinning, which developed in England and was copied in the United States almost one hundred per cent. (R. p. 64)

The author starts on page 280 with a discussion of winders to wind this cross-wound type of package, and he begins to specialize on what he describes as quick traverse winding frames on page 282. The cross-wound package is the package like Plaintiffs' Exhibits 5, 6 and 7. The author describes this type of frame as follows:

‘‘If we take 15 degrees as the lowest angle which will bind the yarn into a ball which will stand packing and handling, it is clear that the relation of output to traverse must be the same for all frames which are building cheeses, because for
every 38 inches of yarn would the thread must
42 be taken twice across the face of the 5 inch cheese,
and this necessarily means that some traverse motion and bar must move a series of guides, one for each cheese, backwards and forwards once in that time. For yarn which would wind at 1,200 feet per minute it is obvious that the bar would have to move at a speed of 170 feet per minute and reverse its motion instantaneously 400 times in doing so. As yet no motion has been found which will stand this strain for any length of time, and most quick traverse machines can not compete where speed alone is the

desideratum; but there are several of them which do good work at more than half that speed, with the additional advantage that four parallel ends may be wound together on to the same cheese, being so arranged to run through detectors that all of them stop at once if any one of them breaks down."

The discussion then runs from there on to twisting of yarns rather than just straight winders. (R. pp. 64-65)

I am the Edward J. Abbott named in patent No. 1,700,425. I assisted in the invention and design of the machine shown therein. I have had experience with machine designing. I learned my trade primarily as a machinist at the Baldwin Locomotive Works in Philadelphia; and then I worked there for a number of years as a designer in their selling department; and then I went to Wilton to take charge of the Hillsboro Mills and I continued research work, designing, experimental work on machinery, and other technical fields; and I have continued that up to the present time. (R. p. 65-66)

I am the patentee of various patents not only in the textile field but in other fields. Most of the patents have been on winding machinery, spinning machinery and dyeing machinery. (R. p. 66)

(The machine previously set up for demonstration was offered by the Plaintiff and admitted as Plaintiffs' Exhibit 8.) (R. p. 66)

This patent No. 1,700,425 concerned itself broadly with a winder to wind onto these cheeses and cones while they were carried around in a race-track course and to doff and don them automatically at one point in the travel of the circuit and, also, to find the ends on the bobbins and on the packages and tie them together. There were also a number of other automatically operated mechanisms working
43 on the packages as they moved around the machine.

The traverse motion to move the slider to and fro, to make the quick traverse package, best shown in Fig. 4, was a small diameter cam, approximately two inches, with a cross-groove, and running in the cross-groove a boat-shaped slider or a boat-shaped dog, and this, in turn, was pinned to a slider which traveled to and fro across the face of the package on guide rods. This cam was made of cast-iron in the original experimental model and was made hollow with ball bearings in the ends. The cam was arranged loose in the framework, so it could slide in and out and be pressed by a spring against the tractor roll illustrated by 50 in Fig. 3. (R. p. 67)

The spring did not act on the frame in which the tractor roll was carried. The frame was guided by the supporting rolls, No. 4, with vertical rollers, No. 22, and the frame was supported by the rolls 16, so the frame itself could move along the rolls, but could not move in or out. The cam, however, could move in and out, pressed in by springs working on the gudgeons which fitted in the ends of the cam. The cam was then fitted with metal tires, 121, whose surface was slightly above the surface of the cam, and it was these tires which were pressed against the tractor roll 50. If the tires and the cam were urged against this tractor roll the whole unit of winder mechanism traveled along the rails, No. 4, down one side, around the end, down the other side, and so on. They were each one attached to a chain, which was wrapped around sprocket wheels at the end of the frame, and each head was attached to this chain so they all moved in unison around. By "head" I mean this total traveling unit painted green on Exhibit 8 that moves to and fro on this track. (R. pp. 68-69)

In the machine shown by the patent No. 1,700,425 the core which formed the center of the cheese or cone, No. 147, was mounted on a spindle, No. 26, shown in Fig. 4, and this spindle, in turn, was attached to a casting, No. 27, which was bored so as to slide vertically on a rod, No. 19, this rod, in turn, being fastened securely to the main framework of the traveling head (R. p. 69).

44 As the package was wound and increased in size, the spindle and this casting would rise and accommodate themselves to the size of the package, the weight of the package itself and the weight of this casting and spindle serving to press the package down on the tractor roll 50 and cause enough friction to rotate it. As the tractor roll 50 was rotated, rotating the package as I have just described, it also rotated the cam roll, and that operated the traverse, making the guide eye, No. 126, move to and fro in front of the package (R. p. 69).

We built one model; one machine like the one shown in the patent which I have just described. On that machine we employed the usual cast-iron cam. It had soft steel tires to contact with the roll 50 which caused the cam to turn (R. pp. 69-70).

I produce one of the cast-iron cams which we used in the model machine which we made generally as illustrated by the patent No. 1,700,425 (R. p. 79-A).

(The cylinder so produced and identified was offered by the Plaintiff and admitted as Plaintiffs' Exhibit 10.) (R. p. 79-B.)

This is a cast-iron cam which has seen actual service.

That machine had two round rods that ran right across the top of the cam and on that was a slider made so as to slide on one rod and be guided from revolving by the other rod; and that had immediately above it a guide through which the yarn passed on its way to the package. Those rods in that design had to be immediately above the cam because the cam moved out, and in that way there was less misalignment between this dog that ran in the groove and the cam groove. The two rods that I have been referring to as being above the cam occupied a position about corresponding to in front of the present rod and a position about corresponding to these screw holes on Plaintiffs' Exhibit 8 (R. p. 70).

We ran that machine experimentally a few hours at a
time and tried to give it some steady runs, more to
45 see what we could do winding yarn and producing
some good packages and getting a general idea what
the cost would be. We were much encouraged by the savings in labor. The packages that we wound were fairly good but needed improvement. The most vital objection was with the quick traverse motion—what I have been calling the slider (R. pp. 70-71).

We wanted to run the machine at least at what was then considered fast commercial speeds of 400 picks per minute; but when we attempted to run at those speeds the boat-shaped dog and the slider would break. I did not make very extensive investigation there, because the parts would only run at about half the speed we planned for any length of time without either the dog or the slider coming apart. My recollection is that we had trouble with it right along at almost any speed. It would run quite slowly, a hundred or two hundred picks per minute (R. p. 71).

To remedy these troubles I designed an entirely different kind of winding head, which was modeled closely after this present commercial head that is on Plaintiffs' Exhibit 8. The most important changes in the general design were the fixing of the cam with its bearings positively in the frame of the head, so that the cam and the slider rod were always in exact alignment. And then I moved the slider rod forward and down into the triangular space between the tractor roll and the cam. Instead of using a rod of that shape, I experimented with a number of other shapes of rods, rectangular and square; and I picked, as being the best one, a triangular shaped rod, which served not only to guide the slider to and fro but also kept it from turning around. That gave a slider which was considerably lighter and could be run in good alignment to the cam and also brought the traverse eye much closer to the yarn surface (R. p. 72).

We had had considerable trouble with this first model, designed as patent No. 1,700,425, with the steel tires nicking the tractor roll; also, we could not get a good traction between them. 46 If we pushed them hard enough against the tractor roll to get good traction, we scored the tractor roll, and the bouncing on there would nick the tractor roll; and that, in turn, would cut the yarn. So we tried cork and rubber tires, some form of soft, resilient tire, and that had a peculiar effect in this case, in that the tire had a very good adhesion, but still—that is, it had enough adhesion to revolve the cam, even though it was pressed very lightly against the tractor roll—at the same time it offered very little resistance when the winding units were moved around the frame. The reason for that seemed to be that the material was soft enough or plastic enough so that while the point at which the adhesion was occurring between the tangent points of the tire and tractor roll were in good contact and were not sliding, the material itself would flex and let the whole head move slightly ahead. That movement is quite small; it only moves about 1/200 of an inch for each revolution of the roll,—that is, for each revolution of the roll the unit advances along the machine about 1/200 of an inch; that is about five-thousandths of an inch, about the thickness of the tin in a tin can (R. pp. 72-73).

We found that cork was the best material, because there is a certain amount of oil that does get on a tractor roll, not necessarily lubricating oil but oil that is used to lubricate the fibers in spinning, olive oil, castor oil, peanut oil. So that there is a very slight film of oil on this tractor roll (R. p. 73).

Cork is a material made up of a great number of round, hollow cells stuck together with some natural glue; and when the material is cut and formed a great many of these cells are cut in half and they act as little vacuum cups on any smooth surface and cause excellent adhesion (R. pp. 73-74).

Adhesion is something where there is no slip. Friction is where the two surfaces are slipping against each other.
You can see it on the locomotive: As long as the tires
47 have adhesion on the rails the train is pulling; but
all of a sudden they will begin to slip and then there
is friction. So the adhesion you get for a given pressure between two materials gives a much greater driving power than the friction between two materials. Hence in this case where we were using a metal tire we moved along slowly and there was, therefore, always a constant slipping between the two surfaces, that is, between the surface of the tire and the surface of the roll; and that, of course, prevented any possibility of there being adhesion between the two. On the other hand, some softer, resilient material could keep its surface against the face of the tractor roll without slipping and still permit a slight motion of the traveling unit on which it was mounted. We found cork to be superior to rubber or leather or other similar materials in that it retained its adhesive quality even in the presence of oil; whereas some of the other materials became slippery (R. p. 74).

We found that the actual power it took to drive these hundred or more heads around the machine was no greater using this resilient material, like cork or rubber, than it was when we were using the smooth steel rolls (R. p. 74).

I have here one of the sliders we used (R. p. 75).

(The triangular rod traverse slider so produced and identified was offered by the Plaintiff and admitted as Plaintiffs' Exhibit 9.) (R. p. 79-A.)

This was one of the lot put through that we used and which I described as a triangular shaped slider; and this type of rod and slider and dog was used on the model winder which we made up and which I have been describing as being similar to Plaintiffs' Exhibit 8. The dog on this model had curved sides. The guiding member was made of steel, in a triangular shape, in the form of half a square; that is, one 90° angle and two 45° angles (R. p. 75).

48 This second machine that I have just described was installed in the Hillsboro Mills and was given a fairly good run under actual service. It was run for several months at least and various lots of yarn wound on it and tests were made for cost of operation and we found that we could run this machine at the ordinary commercial winding speeds of 400 picks per minute, although we had considerable breakage of this slider and dog. We were using some cast-iron cams that we had had on the first experimental model. We had quite a few other features in the design of the machine, such as the support of the package itself by a swinging arm, and we had a different method of driving the tractor rolls and an entirely different method of operating tensions and lifting the package off and on the roll automatically. We were using this triangular slider and the slider itself was the thing that gave most of the trouble. It seemed to jam on these rather sharp angles on the triangular rod and did not seem to slide even as well as the older model did. It ran hard and needed a great deal of lubrication to make the machine run successfully (R. pp. 75-76).

I did not work so much on that machine experimentally; but we continued experiments in our research department experimental rooms on different designs of dogs and sliders, different shaped slider rods, and we checked a good many of these on this machine that was at the Hillsboro Mills in actual service and I obtained very irregular results (R. p. 76).

A dog on a slider which would apparently run very well one day would go terribly the next day, so that I spent quite a time trying to find out why this was; and I found it was due to the cam rather than the slider or dog or rod. The cams were cast-iron; and if I took a new cam and set it up and ran it, it would go very well for a while. After a few days it would begin to go badly, the traverse would be noisy, and either the dog or the slider would begin to break (R. p. 76).

49 Apparently this breakage was due to the fact that the points on the cast-iron cam would deteriorate, and the distance which this dog has to travel in crossing over from one groove to the other, where you might say there is a piece of the wall of the groove absent—it is quite important to keep that space as short as possible; otherwise, instead of the dog sliding smoothly from one groove to the other, it begins to hammer on the point and then bounces back from the point, over to the other side, and chatters; and, as it goes through the groove, this can be seen in one of the high speed examination machines, with special lights and timing on the lights. Apparently this was what made the cam run hard in the groove and what caused the dog or the slider to break. It did not need very much deterioration of these frog points to increase that distance quite a bit (R. p. 77).

Well, I developed quite a few ideas there to try to bridge that distance, making the dog flat on the side instead of rounded; and, while that helped, it was still a difficult thing to get it across without vibration (R. p. 77).

Then I took one of the cast-iron cams and made some hardened points of steel and inserted in it and that immediately ran much better. You could tell from the noise that it was running smoothly over these cross-overs instead of hammering. That seemed to be the point to observe and prove, so that I then worked on a number of ways of making these cams hard, so I could maintain this whole cross-over condition so that the points would be maintained and not only be sharp and hold their position when the cam was new, but would hold that position during the life of the machine (R. p. 77).

I finally decided that the best way to do so was to harden the surface of the cam; and the final method I worked out was to turn the cams from solid bars of steel, machine these grooves in them with end mills, and then to do the necessary machine work on the ends of the cams to
50 fit the bearings in and then harden the surface of the
cam, in this case hardening it all over, because there was no reason to try to blank off certain portions of the surface; that would be harder to do than hardening it all over the surface. The object in hardening the cam was to get hard points, and I hardened the whole thing in order to do

that. There are four points on these cross-overs. Two of them are very acute; and then there are two rather obtuse ones. All of them deteriorate with the cast-iron cam but stand up extremely well with the hardened steel cam (R. p. 78).

I was able to get sharper frog points with steel than with cast-iron, and that is very necessary with some of these cams. We were more or less tied in on this design to a good winding ratio; and in some cases, in these three to one, the groove is at a quicker pitch and the frog point is not so sharp; but on cotton yarn, which is probably the biggest field for winders, a four to one ratio is more desirable and in that case the frog points become sharper and there are more of the cross-overs. I was able to get a sharper frog point on the steel four to one cam than I was able to get on the cast-iron four to one cam. This cam in Plaintiffs' Exhibit 8 is a typical four to one ratio. The advantage of getting a sharper frog point, even on cams of the same ratio, is that it cuts down this distance, the distance where there is a break in the wall of the groove (R. pp. 78-79-A).

The cam Exhibit 10, shows the difficulties with the frog points that I have been explaining. That is very typical of the condition of the cam after it had run for a short time. Some of the frog points are broken off at the extreme tip and that increases the gap over which the bolt has to jump. I found that the size of the gap was the determining factor in preventing breakage of the dogs and sliders. There are a very great many limiting conditions. That gap can be decreased by making the groove narrower; but then 51 the stem of the dog and the dog itself is thinner and the stem is smaller in diameter, which makes it weaker still and will promote breakage. If the groove is widened to give a more substantial stem, then this break in the wall of the groove is increased (R. p. 79-B).

I made the changes as I have said in the cam, in the material of which it was made, and in the tires. We redesigned that model of slider Exhibit 9, and went back to a round rod. There is some tendency for a slider to rotate on a round rod (R. pp. 79-B-80).

In the first model as shown by patent No. 1,700,425, we had to have two rods, and two rods were common in most winders to guide the slider. In this case, however, to get this slider and rod down in this small triangular space between the cam and the tractor roll, there was not room for two rods of sufficiently large diameter. However, I found that I could use one rod and then use the cover plate, which ran close over the slider, as the guide, to keep the slider from turning on the rod. It employed a cover plate over this triangular slider and dog of relatively thin material, but it did not touch the slider or form any guide for it. The cover plate to which I have referred is this white nickel-plated piece attached to the head, the moving head, of Plaintiffs' Exhibit 8 (R. p. 80).

I produce an assembly of one of our present commercial sliders, with dog and the rod on which it slides (R. p. 80).

(The assembly of a commercial slider, with dog and the rod on which it slides, so produced and identified, was offered by the Plaintiff and admitted as Plaintiffs' Exhibit 11.) (R. p. 81.)

I made these changes I have talked about; I hardened the cam; I got the sharp frog points; I had the resilient tires on the cam; and I had this dog. This machine was then run at Hillsboro Mills in actual service and ran very well. We ran it at first 400 picks per minute (R. p. 81).

In our designing and experimental rooms we took
52 some of these heads and made them up more as they
would be made for production; and when we had some of them ready we put them on a test machine and began to run them very fast, to see what would go to pieces first; in other words, we gave them a typical destruction test preliminary to making these slides and putting them on the machine to sell (R. p. 81).

We found this new construction, with those new features, could be run up as high as 2000 picks per minute without any particular breakage or deterioration when run for a short time, say a day or two. It could be run continuously for a week or two at speeds of 1200 picks per minute (R. p. 82).

We then developed this model and tooled up for it and made the necessary jigs and so on and began to sell these winders and to run them, oh, depending on the work, anywhere from 800 to 1200 picks per minute, which corresponds, roughly, to from 500 to 750 yards per minute. The machines stood up very well. We have had some of them running for ten years on that basis, with only very small repair cost (R. p. 82).

I found out in the destruction tests that it is possible for short periods to run this machine up to 2000 picks per minute, which would correspond to about 1250 yards a minute. The maximum winding speed today for this machine is limited by the speed at which the yarn can be unwound from the spinning bobbin which the mills make. The speed of these machines is now practically limited by the speed at which you can take the yarn off these supplies (R. pp. 82-83).

When the thread comes off the bobbin like that, it forms a balloon, the centrifugal force tending to throw it out and the air resistance tending to hold it back, and it balances up in the form of a ballon-shaped affair, visible to the eye. Actually, the yarn is running up in the form of a spiral.
When the speed is increased to too great a point the
53 balloon catches on the barrel and will snap the yarn.
So that in this machine, one unit of which is shown in Plaintiffs' Exhibit 8, I have now reached the maximum speed for these machines, due to the kind of yarn supply I have, in most cases. There are a few mills which have specially built bobbins, where you can get higher winding speeds (R. p. 83).

The hardened steel cam has enabled us to run the winder at a much higher speed; and that, of course, is an advantage in any machine, since, other things being equal, the cost is reduced, the floor space is less. With the winders I was working on it had a very great advantage, because we were having girls tend two, three, four times as many spindles as they had tended before, and the winders were getting longer and longer. Even with these high speeds today we have winders which are tended by one girl up to 180 spindles, which are over eighty feet long, and those winders are going at high winding speeds, anywhere from 600 to 750 yards a minute, as a rule. If we had been restricted by the old, commonly accepted winding speed of 250 yards a minute, we could not have put the winders in a mill; they would have been too long. We could not have utilized the advantages of moving spindles, the automatic features that we put on the winders (R. pp. 83-84).

It makes the winder run very much more smoothly and quietly and it developed one advantage in the oiling. With

the higher speeds you get a tremendous centrifugal force on these cams, so that oil or grease will not stay on them. With the same number of picks or windings there is a higher centrifugal force on a small cam than there is on a large one, in the same ratio as the diameter, so that the small cam which we employed was two inches in diameter and had six times the centrifugal force to throw oil off a cam like the one offered as an exhibit of, say, twelve inches in diameter. The result was that we had to lubricate that groove by feeding oil under this slider rod and it ran from that down
the stem of the dog and down the faces of the dog
54 and lubricated the face and wiped off itself on the
walls of the groove and so almost immediately spun
away (R. p. 84).

Well, now, that oil, in that case, if fed in any quantity, would spin itself off on the surface of the tractor roll and dirty the yarn. So that the lubrication has to be very slight (R. p. 84-85).

With the same number of revolutions the centrifugal force would be greater, I should think, on the big cylinder. There is a well understood principle in centrifuges. They make them small in diameter and run the revolutions up, rather than make them big in diameter and slow the revolutions. The same linear speed on the outside will give you more centrifugal force (R. p. 85).

The thing that determines the picks per minute or the winding speed per minute is the surface speed of the cam rather than the number of revolutions of the cam, because the groove is cut in at the same angle on the little cam as it is cut on the big one (R. p. 85).

Well, this lubrication had to be very slight, just a bare trace of oil on the surface of the slider; and with cast-iron apparently that is not enough at high speeds. It has to be —there has to be established there a complete oil film to prevent excessive wear (R. pp. 85-86).

However, with this hardened groove, we apparently were able to run it almost dry with a very sketchy lubrication, and, instead of cutting like the cast-iron, it would smooth itself and polish. You need some lubrication or it would heat up, sparks would begin to fly, and the whole thing would catch fire. Now, with a very little oil on this thing, with a hardened groove, we can run extremely high speeds; whereas, with a cast-iron groove, any attempt to increase speeds will make a cutting (R. p. 86).

Cast-iron makes a wonderful bearing so long as it is flooded with oil; but it cuts very fast as soon as any dry surface is exposed (R. p. 86).

55 The cork tires enabled us to drive this cam at the high speeds which we found we could get from the other features of construction, without any bouncing on the steel tractor rolls and it gave it a uniform speed without any slipping. The slight volume of oil which came off the yarn and came from the lubrication was not detrimental to the adhesion of the cork on the steel. The greatest advantage probably was in the ability to use a material like this and still move the heads endways. The cork also has a rather polishing or cleaning effect. It is an absorbent material, which will absorb a certain amount of oil from the roll (R. p. 86).

The great advantage in the slider Exhibit 11 was that we only needed one rod and then we could tuck the slider and rod down in this triangular space between the cam and the roll and make it very much more compact and, hence, lighter; and the upper face of it only had to be flattened to use as the key or guide against turning; that is, the flat surface on the upper part of the slider bore against the cover plate and prevented the slider from turning on the round rod on which it slid (R. p. 87).

Putting this slider down in the little triangular space between the driving roll and the cam enabled you to get a light, compact slider. There is an enormous advantage in making it light, because the forces set up by reversal vary as the square of the weight. Halving the weight would cut the force down to a quarter (R. p. 87).

There is another advantage in having this slider compact and set in where it does set in, other than being light. The nose or neck of it, that extends towards the nip between the package and the roll, is very short and can be made strong and it is really just a short extension from the main member. It is important to get the thread-guide at least near the nip of the rolls. It must be placed just as near as possible to get a properly wound package. If it is placed any considerable distance away the package is built up on the edges and makes raised flanges, which are objectionable (R. pp. 87-88).

56 The Foster patent No. 459,039 shows the slider in Figs 6 to 7^a; that is mounted on two rods. The purpose of having two rods is to keep the slider from revolving around the axis of either one of them. Such a slider could be run at the old speeds. It is almost twice as heavy as the one illustrated by Exhibit 8—probably even more so, the way it is shown. I do not think it could be used at the new winding speeds that I am now able to get with my new machine. (R. p. 88)

The limitation on this design is not so much due to the slider as it is to the little roll g or g^1 in Figs. 4 and 3; and that roll appears to be so small that it would have to run at enormously high speed to even approach the old commercial speeds of 200 yards per minute. (R. pp. 88-89)

What the inventor used there was apparently to put this small roll in, which he does not use in Fig. 8, so that he could bring his slider up close to the nip between the package and the small roll. He uses a fairly large diameter cam, I should judge six or eight inches in diameter, so that if he rested the package directly on this cam, as in Fig. 8, and he had a fairly large diameter package, say, winding up six or eight inches in diameter, he could not get his slider in close to the nip at all. However, by using this small roller g he could move that slider in more closely. (R. p. 89)

If you took that slider mounted on the two rods shown in the Foster patent No. 459,039 and mounted it on the machine illustrated in Plaintiffs' Exhibit 8, I do not know how fast it could be run. It could not be run very fast, I should judge. It is quite heavy. It is two or three times the weight of the slider shown on Exhibit 8. In the case of the Foster slider, running on two rods, you would expect to get a sticking of the slider as in the case of this slider on the triangular rod, Plaintiffs' Exhibit 9. Practically it is almost impossible to line up two round rods like that and have two holes drilled in them so that
57 they will slide. The least bend on either one of the rods would make it jam. You could not apply this construction, because you could not put two rods in that triangular space. (R. pp. 89-90)

I refer to the Rhoades patent No. 867,153. That has a slider which appears to be mounted on a rod 14. I am not sure from the drawings of the cross section of rod 14. It shows rectangular in one place and round in the other. I imagine it is a round rod, squared off on the ends and fitted into this slit in the main frame. That slider is kept against rotation on the rod on which it slides. It is extended down in behind the rod 21. It shows on Fig. 1, where it carries a sort of a hook-shaped piece, in back of this 21, 22 rod or cam. That keeps it from going one way. And then there is an extension piece down in front, marked as 17, which keeps it from moving the other way, although, as drawn, it looks as though the dog running in the groove prevented it from swinging in from the front. And then the hook on the side opposite the dog kept it from swinging out the other way. (R. p. 90-91)

It is rather difficult to give an opinion as to how many picks you could get with a slider of that construction; the two machines are so radically different with relation to winder picks. There is no description of the speed of the Rhoades machine at all. I can only consider the speed as, possibly, in relation to machines of that kind which I have seen in operation. (R. p. 91)

At the time of this invention, they ran quite slowly, giving fifty to sixty yards per minute, taking the yarn from spools. The picks, of course, would be very slow, because in a machine like this the picks are about 54 inches long; whereas, on the winder or winders we have been talking about they are only 6 inches long. I do not know whether the Rhoades slider would stick if an attempt were made to run the Rhoades slider fast. It is so heavy that you could not possibly run it anywhere up near to the winder speed. (R. pp. 91-92)

58 In the English patent to Voigt No. 2102 of 1901 the inventor has illustrated the slider like a right angle, one part of it, marked as O, extending in between some guides formed by the outside casing and then the other side of the right angle D extends through other portions of the casing and in this case extends to the outside and forms a guide eye over the arm for the yarn, marked E. The dog in this case is formed of a roller P, which runs in a fairly wide groove in the cam. The slider itself is not mounted on a rod for motion to and fro, it is guided by running in these straight parts of the casing. One side

of the angle apparently is meant to keep it from going in one direction; and the other side of a right angle section keeps it from going in the other direction, so that, between them, they form a guide which keeps it in line. I do not think this slider could be operated at speeds possible with the slider shown in my application, because I think it would jam badly when the cam presses on the dog, as it does, due to the angle of the cam. I should think it would cramp the parts which would extend through these flat guides. (R. pp. 92-93)

My machine, as shown in the application in suit, was offered to the trade. The average mill man took it for granted that the machine was all right and merely looked for the advantages of labor saving and the general appearance of the machine; the engineers did not think it was possible to do it. One of the best instances I have is where a winder manufacturer in Germany, Schlafhorst & Company, sent engineers over twice to check the speeds. Their engineer who came over first, Mr. Muerkens, took the speeds of winders in actual service. He would not believe what I told him. And he went back and reported to his chief, Dr. Reiners. Dr. Reiners would not believe his report and sent him back a year later, accompanied by another engineer, and they were finally persuaded
59 the winder could run at these high speeds, 600 to 800 yards per minute, commercially, without serious wear and noise. (R. pp. 93-94)

(The machine, Plaintiffs' Exhibit 8, was operated without the cover and without winding thread. The cover plate was put back on the exhibit machine and it was operated, winding thread. The witness measured the speed with a tachometer.) (R. p. 94)

I get speeds running about 675 yards a minute on the average. That machine can be run faster than that. We have been running commercially up to 750 yards per minute. The model is small and not well supported and I have not attempted to run it faster. I picked a typical model of commercial machine. (R. p. 94)

I produce some advertising matter for the new winders shown in the application in suit.

(The booklets so produced and identified were offered by the Plaintiff and admitted as Plaintiffs' Exhibit 12 and Plaintiffs' Exhibit 13.) (R. p. 95)

The picture on the first page of Plaintiffs' Exhibit 12 represents the Proximity Manufacturing Company at Greensboro, North Carolina. About three hundred of these winders are out now. They will range from 60 spindles up to 180. 100 is a good average. Last year we sold about 25% of the business of making and selling winding machines to wind packages like Plaintiffs' Exhibits 5, 6 and 7. The chief business of the Foster Machine Company is making winding machines to wind packages like Exhibits 5, 6 and 7. They are probably the oldest and the best established firm. I do not know that they are the largest firm, but they are one of the largest. (R. pp. 95-96)

Since my invention the Foster Machine Company has made changes in their machine. The chief change has been in the method of driving the quick traverse. They have abandoned the large cast-iron, single groove cams, which were characteristic of their winders for 30 years or more, and have adopted a small diameter hardened steel cam, positioned in front of the tractor roll, instead of behind it or under it, with a slider and slider rod and dog quite similar to this model, Plaintiffs' Exhibit 8. (R. p. 96)

60 I produce one of our present day cams, taken right out of the production line. (R. p. 96)

(The cam so produced and identified was offered by the Plaintiff and admitted as Plaintiffs' Exhibit 14.)

This is the kind of cam that is in the unit that is Plaintiffs' Exhibit 8. (R. p. 97)

Cross-Examination:

This thread machine on which this winder is shown here, is in its broader aspect the same as the machine which is shown in my patent No. 1,700,425. This particular winder is intended to be used with what I believe you called a race-track machine, as shown in that patent. (R. p. 97)

I spoke a while ago of this cast-iron cam deteriorating at the points. The cause of that deterioration is due to the engagement of the points against the dog. I should not say it is worn. It is a matter of breaking it; of crumbling it. It is caused by the rapid motion of the dog which strikes against the points. I do not think a sliding contact would wear it very fast; but it is the shock or impact when it hits the points. To avoid that I decided that I should use a harder metal than the cast-iron. (R. pp. 97-98)

Case hardening was a well known process at that time; it is an ancient thing. (R. p. 98)

Evidence on Behalf of Defendant

Defendant offered in evidence as Defendant's Exhibit 1 a folder of patents and decisions containing the following items (R. p. 99):

A—Foster patent 459,039
B—Rhoades patent 867,153
C—Abbott patent 1,700,425
D—Muller patent 1,551,764
E—Birkigt patent 1,938,566
F—Rowley patent 72,087
G—Stevens patent 1,566,704
H—Voigt British patent 2102 of 1901
I—Jones British patent 108,407
J—Prints of drawings of Application Ser. No. 506,530
K—Examiner's Statement
L—Decision of Board of Appeals

(The folder so produced and identified was offered by the Defendant and admitted as Defendant's Exhibit 1.)

61 *Rebuttal Evidence on Behalf of Plaintiffs*

EDWARD J. ABBOTT

Edward J. Abbott, heretofore sworn as a witness on behalf of the Plaintiffs, was recalled, examined, and testified on further

Direct Examination:

I refer to the Rowley patent No. 72,087. The inventor says the friction drive is India rubber, leather or other suitable material. That is the tire G, as he calls it. That patent does not show any endwise movement of the disk F with its tire G of rubber. It does not show any movement at all analogous to the movement of the tire along the roll in the application involved in this case. (R. p. 100)

I refer to the patent to Stevens No. 1,566,704 which shows a rubber driving ring or tire. There is nothing illustrated here to show any endwise motion of that rubber tire on its ring or with its ring such as I have in the tire of cork or rubber shown in the application in suit. It relates to a certain machinery known as a slitter ring, and I am not familiar with that industry. I do not know what it does. (R. pp. 100-101)

Stipulation

We hereby agree that the foregoing statement of evidence and exhibits contain the substance of all the evidence given on the hearing of this cause.

ROBERTS, CUSHMAN & WOODBERRY
Attorneys for Plaintiffs

ARLON V. CUSHMAN
Solicitor for Plaintiffs

R. F. WHITEHEAD
Solicitor for Defendant

62 Pl Ex 1 PJM

390

Department of Commerce

United States Patent Office

To all persons to whom these presents shall come, Greeting:

This is to Certify that the annexed is a true copy from the records of this office of the Specification, as originally filed, with the exception of the claims; and Papers 22 and 25, in the matter of the Pending Application of Edward J. Abbott, Filed January 5, 1931, Serial Number 506,530, for Improvement in Winding Machine.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this fifth day of October, in the year of our Lord one thousand nine hundred and thirty-seven and of the Independence of the United States of America the one hundred and sixty-second.

CONWAY P. COE,
Commissioner of Patents.

(Seal)

Attest:

C. W. SUTTON
Acting Chief of Division.

63 Specification.

To all whom it may concern:

Be it known that I, Edward J. Abbott, a citizen of the United States of America and resident of Wilton in the County of Hillsborough and State of New Hampshire have invented new and useful improvements in Winding Machine of which the following is a specification:—

64 This invention relates to winding machines and relates more particularly to the traverse devices of such machines, and to various strand-handling machines performing a winding function. My invention is particularly applicable to machines having traverse devices adapted to lay a winding strand (for instance, of yarn) in successive layers of reversed quick-pitch spiral windings, thus to form a headless self-sustaining cylindrical or conical package or cheese, and will be explained in this connection. The present application contains numerous features and attains certain of the objects of my copending application, Serial No. 476,776, filed August 21, 1930, entitled "Machine and Method for Preparing Yarn Packages", and is in part a continuation of that application.

Among the objects of the present application are to provide in a winding machine a more durable rotary traversing element than heretofore, and to provide a traversing device which may be run continually at high speed without excessive vibration or wear and without deviation of the winding strand from the desired pattern of winding.

The present invention, while possessing features of general applicability in winding machines, is especially adapted for cooperation with the circulatory carriers and general organization of cheese winding machines of my patent No. 1,609,639 dated December 7, 1926, of the patent of E. J. and W. G. Abbott, No. 1,700,425, dated January 29, 1929, and of my above copending application. My invention has for another of its objects to provide in such machines a relative adjustment of the traversing devices and of the holders of the winding packages on the carriers of circulatory textile machines, such that each package may be wound on its core in the same position with relation
65 to the lengthwise dimension of the core. Accordingly

a package wound on one of the carriers, and then depleted by unwinding, may be built up to full size on any of the machine's other carriers, indiscriminately chosen. Thus a circulatory-carrier cheese winding machine, improved by my present invention, may be used for the building up of depleted packages without regard to which carrier is utilized for such supplemental winding, the operator (or an automatic substitute thereof as disclosed in patent No. 1,700,425) preferably placing the depleted package on the winding spindle of the first inactive carrier which passes. The improvement of the present invention then renders it possible for the winding machine to complete a partially depleted or unfinished package by laying supplemental layers of windings in exact endwise correspondence with the original layers of reversed spiral windings of the package, so that there shall be no appreciable discrepancy between the new end surfaces defined by the cusps of the new spiral windings and the old end surfaces defined by the similar cusps of the original underlying spiral windings.

Numerous other objects of invention, advantages, and features of novelty will be apparent from a consideration of the specific instance of my invention explained by way of example only, in this specification and its accompanying drawings.

In the drawings:

Fig. 1 is a diagrammatic plan view of a circulatory-carrier winding machine to which the present invention is particularly applicable, this view omitting many of the frame, driving and controlling parts of the machine, and all but two of its numerous circulating winding carriers, for clarity of illustration;

Fig. 2 is a fragmentary vertical section on the line
66 2-2 of Fig. 1, showing the upper portion of one of
the circulatory winding carriers on the guideway
of the machine;

Fig. 3 is a horizontal section on the line 3-3 of Fig. 2, showing in plan the traverse mechanism of the carrier, the cover plate of the carrier being removed to expose parts beneath;

Fig. 4 is a fragmentary vertical section on the line 4-4 of Fig. 3 through the rotary traverse barrel of the carrier and its driving roll;

Fig. 5 is a plan of the strand traverse guide of Fig. 3, to a larger scale;

Fig. 6 is a side elevation of one of the circulatory carriers of the machine, the cover plate of the carrier and the tension, slub-catching and detector devices mounted thereon and associated therewith being removed to show the rotary traverse barrel;

Figs. 7, *7a* and *7b* are fragmentary views, taken on the line 7-7 of Fig. 4, at respectively different times in the period of rotation of the traverse barrel or cylinder; and

Fig. 8 is a fragmentary horizontal section on the line 8-8 of Fig. 6, showing one of the two opposite end bearings of the rotary traverse barrel; and

Fig. 9 is a fragmentary horizontal section on the line 9-9 of Fig. 2.

Referring to Figs. 1 and 6, the machine illustrated as exemplifying the present invention includes in common with the machines of the above patents and application, a continuous guideway constituted of upper and lower rails 4 and 5 supported by any suitable frame, and defining a closed path of circulation for a large number of
67 winding carriers 10 along opposite straight and semi-circular runs. Suitable means for moving the carriers along the guideway may include an endless chain 30 running on sprockets 36, 36 (one of which is suitably driven), the carriers being severally connected to this chain as hereinafter described so as to be moved thereby in the direction of the arrow *x* in Figs. 1 and 6.

As preferably constructed an individual winding carrier includes an unright frame element or plate 60 (Fig. 6) adapted to bridge the distance between the rails 4 and 5 and provided at its lower end with a horizontal projection 61 carrying an anti-friction roll 62 and a steadying pin 63, roll 62 and pin 63 embracing between them the vertical flange of the rail 5.

At its upper end the plate 60 may be integral with or attached to an upper head portion 65 which constitutes a part of the frame of the carrier 10, for example by bolts 64. The head 65 has outwardly projecting parallel end plates 66 and 67 spaced apart to provide room between them for a rotary traverse cylinder 70 having a groove therein which determines the configuration of the wound

layers in the winding package. One of the end plates of the head 65 may be extended as shown at 68 in Fig. 2, and terminate in a split clamp 66^a adapted to retain a stationary pivot pin 66^b. Upon this pin, a package-carrying arm 71 may turn, this outer end of this arm 71 forming a split clamp for a spindle 72 for a winding core or package carrier *w* (Fig. 2). As shown in plan in Fig. 9, the outer portion of the package-carrying arm 71 is provided with a boss 71^a surrounding the spindle 72, the boss being of appropriate size and shape to form an abutment for the rear end of a rotating core *w* as the core is rotated by the roll 50. As the carrier progreses along the tractor roll, the reaction of the roll 50 upon the core or a winding package thereon, serves yieldingly to retain the rear end of
68 the core *w* in contact with this abutment, thus accurately positioning the core in an axial direction with respect to carrier; regardless of the exact length of the core.

A suitable holder for a supply of yarn to be wound is provided on the carrier, preferably in the form of a spindle pin 122^c (Fig. 6) adapted to receive a spinning or like bobbin. The supply holder is located in position for a winding strand leading therefrom to pass the traverse barrel 70 on its way to a winding package on the spindle 72, the traverse barrel 70 being provided for the purpose of imparting reciprocatory movement to the part of the strand approaching the winding package to cause the strand to lie on the package in overlapped layers of quick-pitch spirals. This manner of winding forms the typical Fiji-wound headless self-sustaining package of cylindrical or conical form having the desirable property of extreme ease of unwinding.

For rotating the winding package so as to wind thereon, any suitable driving instrumentality may be employed, but preferably the machine is equipped with drive means common to a plurality of circulating winding packages. Such drive means is herein illustrated as including the driven tractor rolls 50 and 51 of the above patents and application, these driven tractor rolls extending along opposite straight portions of the guideway, and having associated therewith any suitable motor or connections to a course of power, such for example as is described in the

above patents and application. With such a construction the length of the lever arm 71 is such as to bring the surface of winding core w or the winding thereon always into surface contact with one of the rolls 50 or 51 adjacent to which the carriage 10 is being traversed, and the offset position of the pin 66^b is such as to provide an arm 71
long enough to sweep a sufficient arc for the ex-
69 pected radius of the carrier w and the winding upon
it. In normal operation the weight of the arm 71 and its attachments holds the winding mass firmly in frictional contact with the upper surface of the tractor roll 50 or 51.

On the back face of the head 65 at points suitably laterally separated, studs 96 may be provided to carry antifriction rolls 97 which rest on the top surface of the rail 4, and support the weight of the carriage.

Referring now to Figs. 6 and 8, the traverse cam 70, suitably grooved at 70^a, has in a recess at its end an outer ball race 90 taking over a series of balls 90^b supported by an exterior groove in a stationary inner race 91 provided with a nipple 92 fast thereto. Nipple 92 carriers a cross pin 93 to take over the forked and reduced inner end of a pintle 94 which may be retained in a hole in the member 67 of the head 65, as by a set screw 94^a. Preferably both ends of the cylinder are provided with similar bearings, the pintle 94 at the opposite end of the cylinder being secured in an opening in the member 66 of the head 65. This arrangement is such that yarn or fly does not tend to work around the pintle 94, since the latter is stationary.

An annular guard plate 90^c is preferably fitted into the opening of the recess of the cylinder, substantially closing the recess about the pintle 94, to protect the anti-friction bearing. In order that the anti-friction bearing may be easily lubricated, the pintle 94 is provided with a conduit 94^b for transmitting lubricant to the bearing. As shown, the pintle is hollow throughout its length, the conduit 94^b extending to the outer end of the pintle and there being closed by a spring-pressed cap or button 94^c of a suitable fitting 94^d adapted to receive lubricant from a grease gun or the like.

70 The traverse cylinder preferably derives its op-
erative motion from a source common to that of the

driving motion of the winding package; in the illustrated machine the traverse cylinder is frictionally driven by the tractor roll 50 or 51. Preferably the traverse cylinder is provided at each end with a friction ring 70^b of cork, cork composition, felt, rubberized felt, rubber aggregated ground cork, or any other durable friction material, these rings projecting slightly beyond the cylindrical surface of the cam body.

A winding machine according to the present invention may have a large number of carriers 10, each comprising an individually constructed and assembled unit which includes a unit frame carrying one of the rotary traverse elements 70 and the spindle 72 or analogous holder for the core of the winding package. In the use of the illustrated machine, cylindrical or conical headless self-sustaining strand packages are built up on the several carriers, the packages being wound to a predetermined desired maximum diameter, and then removed from the machine.

In using these packages, it often happens that a package will be but partially exhausted, whereupon it is desired to wind on the partially exhausted package other windings sufficient to bring the package again to its maximum diameter.

It will be understood that the relation of the cam groove 70^a lengthwise with respect to the spindle 72 or analogous holder for a core of a winding package determines the lengthwise placing of windings on a core or winding package. In the absence of means whereby a lengthwise adjustment could be obtained between the grooved barrels 70 and the corresponding spindles, the slight differences in form between the various carrier units of a given
machine would result in the practical impossibility
71 of causing a subsequent winding formed on one unit
to correspond in lengthwise position on its core to
an underlying winding previously formed on a different unit.

My invention therefore preferably provides an adjustment of the relative positions of the holder for the winding package, and of the barrel 70 of each individual carrier unit of the machine. Preferably, as shown in Figs. 6 and 8, the two side plates 66 and 67 of the carrier unit are spaced sufficiently from the ends of the barrel 70 to permit

the barrel 70 to be moved axially to some extent. Referring to Figs. 2, 6 and 8, the pintles 94 for the barrel are normally held fast by the screws 94^a. By loosening these screws on any given carrier, the two pintles and the barrel 70 of the carrier unit may be moved axially to such a point that the lengthwise positioning by the barrel 70 of wound layers on a winding package core is the same as that of the wound layers upon a core on any other unit of the machine, or other similar machine. Referring to Fig. 9, the reference character *d* indicates the distance from the end of the core *w*. and the abutment 71^a against which it presses, the series of cusps of the strand windings S on the core. By loosening the screws 94^a and shifting the rotary traverse barrel 70 and its pintles 94 axially, the range of traverse of the winding strand may be shifted to adjust this distance *d* to the desired amount. Preferably in a given machine, the rotary traverse barrel of the several carrier units are individually adjusted so as to lay the windings on each of the several winding cores at the same distance from the rear end of the core. In this way the units of the machine may be rendered interchangeable in respect to the completion of partially depleted packages on any of the several carrier units to produce out-
wardly substantially identical full packages. Thus
72 a package wound on one unit of my machine, and
then partially depleted by unwinding (as for example in a warper creel) may be placed on any of the spindles of the machine and brought to full size by winding additional layers of quick-pitch spiral windings thereon, the ends of these additional layers collectively defining surfaces conforming to the end surfaces of the layers remaining from the previous winding operation.

73 Referring now to Fig. 2, the head portion 65, in-
cluding end plates 66 and 67, of the carriage 10, is preferably arranged to have limited motion toward and away from the tractor rolls 50 and 51 for the purpose of providing freedom in respect to the rail 4 and the roll 50 or 51, for accommodating curvatures at the end of the machine, and to enable the traverse cam 70 to be provided with bearings without lateral freedom of motion, provision being made for resiliently urging the upper part of the carriage toward the tractor roll, thereby holding the rotary

traverse cam in frictional driving contact with the tractor roll. As best shown in Figs. 2 and 3, the head 65, preferably an integral casting, is provided not only with the outstanding end members 66 and 67, but is also provided with rearwardly projecting lugs 76 above the plane of the rail 4, said lugs being vertically bored. The bore in one lug 76 receives the central portion of a pin 77 whose opposite end portions are disposed in bores in the forked end of a link 79 having a bearing hole at its other end to receive a pivot pin 80 carried by the chain 30. The bore in the other lug 76 receives a pin 81 on which is pivoted a link 82 carrying a vertical axle pin 83 for an anti-friction roll 84. Link 82 is provided with a lug into which is hooked a tractor rod 85 extending through a bore 86 in the head 65 and provided with a spring 87 adjustable by a nut 87^a. The spring 87 urges the roll 84 toward the head 65 and against the interior or rear vertical face of the rail 4.

Inward or rearward motion of the head 65, thus induced, is limited on curved portions of the guideway by anti-friction rolls 88, 88 on vertical downwardly projecting studs disposed respectively near opposite ends of head 65 and adapted to bear against the outer face of the rail
4. It will be observed that the contact points of the
74 rolls 88 are laterally separated from the bearing
point of the roll 84; this permits a controlled positioning of the upper end of the carriage 10 in respect to the curved parts of the rail and normally provides freedom between the rolls 88 and the roll 50 or 51 sufficient to permit the spring 87 to hold the traverse cam 70 in pressure contact with the tractor roll 50 or 51.

The fact that the pressure roll 84 has its point of contact with the rail 4 half-way between the points of contact of the tires 70^b and the tractor roll 50 or 51, permits an equalization of the pressure on these two tires, and makes for longer wear.

While various constructions of traverse devices operating on the principle of a rotary grooved cylinder may be employed in the circulating carriers of the machine, I prefer to employ a grooved cam cylinder of small diameter relative to the maximum attainable diameter of the wound package and to provide in the cylinder a spiral groove hav-

ing no more than maximum operative pitch but crossing itself at least once, and usually several times. Such a cam preferably comprises, as shown, an essentially solid bar of steel. The cam, by virtue of its construction, may readily be case-hardened in the region of its groove by heat treatment, and is preferably thus made. The feature of the cam groove crossing itself (preferably several times as shown) is an aid to enabling the cam to be case-hardened without distortion, since with the cam groove thus formed the body of the cam is much more nearly symmetrical than if the groove traversed the cam without crossing itself. The solidity of the cam and its moderate diameter (as contrasted particularly to hollow large diameter cams generally used in strand traversing mechanism) are material
aids in enabling the cam to be case-hardened without
75 distortion, a solid body of moderate diameter being
obviously less subject to distortion under heat treatment than a large hollow body. The case-hardened cam of the present machine offers great resistance to wear and is of improved durability.

The preferred illustrated embodiment of the invention utilizes in conjunction with the groove of the rotary traverse cylinder an improved traversing slider engaging the winding strand and reciprocated back and forth by means of a follower element engaging the said groove.

Referring to Figs. 3, 4 and 5, the head of the carrier is provided with a polished round steel rod 100^a fastened to the opposite plates 66 and 67 by nuts 100^b and constituting one guide for a slider 101^a having revolubly mounted in its lower end a pin 104^a (Fig. 4) which carries a cam follower 105^a engaging the cam groove of the traverse cam 70.

Referring to Figs. 2 and 4, it will be observed that the axis of the guide rod 100^a is in a vertical plane intermediate the vertical planes of the axes of the roll 50 and the traverse cam 70. The shape of the slider as viewed from the side in Fig. 4 may be characterized as generally triangular, the slider fitting within the approximately triangular space defined by the roll 50, the traverse cam 70 and a cover plate 110 for the cam. The slider, as shown in Fig. 4 is provided with a part 101^b extending laterally from the guide rod toward the point of contact of the winding mass and tractor roll 50, this part carrying an upturned

extension 106 comprising the slotted yarn-engaging traverse eye of the slider, and is also provided with a part 101^c extending laterally from the guide rod opposite to part 101^b. These laterally extending parts 101^b and 101^c are preferably flat on their upper surfaces, as shown
76 in Fig. 5 to permit these parts to slide in engage-
ment with the under surface of the cover plate 110 as shown in Fig. 4. The cover plate thus constitutes a key to prevent the slider from rotating on its guide rod 100^a and also a guide relatively close to the bite of the tractor roll 50 and winding package to prevent vibration of the slider as the latter is traversed to and fro by the cam 70. The cover plate 110 acts as a yarn guide and is preferably bent at 110^a in a projecting angle in the path of the yarn, so that the yarn runs in contact with the cover plate from this point 110^a until it leaves the cover plate at the traverse eye 106. The arrangement of parts whereby the slider 101^a is kept in constant sliding contact with the cover plate 110 close to the traverse eye, insures that yarn passing over this portion of the plate will be picked up and traversed by the slotted traverse eye at high speeds of the eye which would cause undue vibration were the slider not thus guided. The attained diminution of vibration of the traversing slider permits the upturned part 106 comprising the traverse eye to be relatively short, and the slot in this eye relatively shallow, thus facilitating picking up of the yarn strand by the fast-moving slider.

It will be readily be apparent that elimination of undue vibration of the traverse eye 106 apart from its intended reciprocatory motion across the winding package is very desirable for the purposes of diminishing wear of the moving parts and preventing unintended disengagement of the strand and preventing deviation of the winding strand from its intended pattern on the winding package. To these ends the illustrated cam follower element is especially formed to cooperate with the groove 70^a of the barrel 70 for smooth running under conditions of extremely high speed.

The traversing groove 70^a may be considered to be
77 constituted of a right-hand spiral portion $70^{a'}$ and a
left-hand spiral portion $70^{a''}$, (Figs. 7, 7^a and 7^b)
these two portions being joined at their ends by curved

connecting portions $70^{a'''}$. The rotation of the cylinder is in the direction of the arrows *y* in Figs. 7, 7^a and 7^b. Referring to Fig. 7^b, the cam follower element 105^a is shown as engaged by the right-hand spiral portion $70^{a'}$ of the groove. The cam follower element 105^a is shaped on its right-hand side surface so that at least two longitudinally spaced points on this side surface will simultaneously contact with the driving side wall of this portion $70^{a'}$ of the groove, and preferably for the major portion of such surface substantially to conform to this driving side wall of the groove. Thus the follower element as it is pressed by the driving wall of the groove is steadied thereby against oscillation about the axis of its pin 104^a.

The opposite or left side surface of the cam follower element is likewise similarly shaped so that at least two longitudinally spaced points will contact with the driving wall of the left-hand spiral portion $70^{a''}$ of the groove, and preferably for the major portion of said surface of the follower substantially to conform to this driving side wall of the groove.

The capability of the follower in its preferred illustrated form to conform successively to the driving walls of the oppositely inclined spiral portions of the groove involves a certain freedom of motion in these portions of the groove as clearly shown in Fig. 7^b wherein the right-hand side of the follower is shown as conforming to the driving wall of the right-hand spiral portion $70^{a'}$ of the groove.

Preferably the lengthwise extent of conformity of the side surface of the follower to the driving wall of the groove is greater than the length of a gap left in the 78 driving wall at the places of crossing of the right and left hand portions of the groove, and in the illustrated preferred embodiment is approximately twice the length of such gap. Thus referring to Figs. 7^b and 7^a, the illustrated follower is shaped to conform to the driving wall of the groove over a distance included within the construction lines *a* and *b*, which are distant approximately twice the length of the gap in the wall of the groove. As a consequence it is assured that while the follower is crossing the gap, the follower will be adequately held by contact with the unbroken parts of the wall against oscillation about the axis of its pin 104^a and against attendant slapping or abrupt striking against one or the other walls of the groove. Referring to Fig. 7^a it will be apparent that before the cylinder has advanced to bring the gap in the wall opposite to the pivot pin 104^a about which the follower would tend to rotate, the forward end of the follower will have engaged the unbroken part of the groove wall past the gap.

While I have described the preferred form of follower as conforming to a wall of the cam groove, approximate as well as absolute conformity will usually suffice to give an easy-running long-lived follower evincing freedom from vibration. Thus while the side driving wall of the groove may constitute a warped surface generated by a radial line rotating and advancing axially of the cylinder, the pitch of the groove is not in general steeper than will admit of a straight-sided follower element approximately conforming to the driving wall of the groove. Thus with the illustrated cam cylinder having a diameter of about $1\frac{7}{8}$ inches and a radially cut groove of rectangular cross-section with an
axial traverse of 6 inches in three revolutions, the
79 follower illustrated herewith in conjunction with this
cam may be characterized as having straight sides between the construction lines *a* and *b*.

The forward and rear, or leading and trailing, ends 105^b and 105^c of the follower are preferably tapered or rounded to facilitate the transfer of the follower from one spiral portion of the groove to the other at the curved connecting portions $70^{a'''}$ of the groove at opposite ends of the cam, the curvature of the ends of the follower preferably substantially coinciding with the curvature of the connecting portions $70^{a'''}$ of the groove, as shown in Fig. 7. Referring to Fig. 7, the follower will be seen at the end point at which it is transferred from the right hand spiral portion to the left-hand spiral portion of the groove, the tapered or rounded end portions of the follower engaging the outer roll of the curved connecting portion of the groove at this point, while the substantially straight intermediate portion of the follower engages the inner wall of this portion of the groove. Thus the follower preferably has little or no lost motion at this point and is not free to vibrate within the groove as it passes from one right or left hand portion of the groove to the other.

As contrasted with a follower of oval or like shape having a distinctly bowed or convex middle portion, the follower described herein affords a materially increased area of contact with the groove walls. As a consequence, the life of the follower is materially prolonged, wear is retarded, and vibration attendant upon wear is diminished.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

80 Signed by me at Milford, N. H. this Second day of January 1931.

[Inventor's Signature:] EDWARD J. ABBOTT

81 Endorsed: Mailed Apr 12 1935

Paper No. 22
K1-as

In the United States Patent Office

Before the Board of Appeals on Appeal

In re Application of
Edward J. Abbott
For Winding Machine
Serial No. 506,530
Filed Jan. 5, 1931

Examiner's Statement

The applicant appeals from the final rejection of claims 8 to 10, 26, 28 and 34 to 38, inclusive. (The remaining claims, claims 25, 29 and 30 have been allowed). A copy of the rejected claims is as follows:

8. A winding machine traverse device for laying a winding strand into layers of reversed spiral windings, including a rotary cylinder having a traversing groove therein, the groove including right and left hand spiral portions crossing each other at least once, said cylinder being of steel case-hardened in the region of the said groove.

9. A winding machine traverse device for laying a winding strand into layers of reversed spiral windings, including a rotary cylinder having a traversing groove therein, the groove including right and left hand spiral portions crossing each other at least once, said cylinder comprising an essentially solid bar of steel case-hardened in the region of said groove.

10. In a winding machine a traverse device for laying the winding strand into layers of reversed spiral windings, the traverse device including a rotary cylinder having a traversing groove therein, the groove including right and left hand spiral portions crossing each other at least once, the diameter of the cam being materially less than the width of the strand package wound, said cylinder comprising essentially a solid bar of steel case-hardened in the region of the said groove.

26. In a winding machine for yarn and the like, the combination of a traverse cam, a slider adapted to be traversed to and fro by the cam, a round guide rod on which the slider slides, the slider having a portion extending laterally of the guide rod in the direction of the winding mass of yarn and carrying a yarn-engaging element, and a cover plate for the cam disposed to contact with the said laterally extending portion of the slider adjacent to the yarn-engaging element.

82 28. In a winding machine for yarn and the like, the combination of a cylindrical traverse cam, a slider including a dog engageable with the cam surface of the cam to be traversed to and fro thereby, a round rod upon which the slider is adapted to slide, and a cover plate for the cam positioned to guide the slider as the latter is traversed.

34. A textile machine comprising a traverse cam, a tractor roll for driving the cam, and a resilient tire on the cam adapted to contact with the tractor roll.

35. A textile machine comprising a traverse cam, a tractor roll for driving the cam, and a tire on the cam adapted to contact with the tractor roll, said tire being formed of cork.

36. A textile machine comprising a traverse cam, a tractor roll for driving the cam, and a tire on the cam adapted to contact with the tractor roll, said tire being formed of rubber.

37. A winding machine traverse device including a traverse guide and a cam follower connected thereto, and a rotary cam adapted to reciprocate the follower, said cam having a groove in the form of connected right and left-hand spiral portions having the relatively steep pitch and rapid reversal of direction adapted for cross-winding traversing by said guide, said right and left-hand spiral portions crossing each other at least once, and the cam being of steel case-hardened in the region of the said groove.

38. A winding machine traverse device including a traverse guide and a cam follower connected thereto, and a rotary cam adapted to reciprocate the follower, said cam having a groove in the form of connected right and left-hand spiral portions having the relatively steep pitch and rapid reversal of direction adapted for cross-winding traversing by said guide, said right and left-hand spiral portions crossing each other at least once, and the cam being an essentially solid bar of steel case-hardened in the region of the said groove.

The alleged invention relates to a traversing means for a strand winding device. This means includes a rotary cylindrical cam having on its surface a traversing groove of right and left hand spiral portions crossing each other at least once. The cam in order to increase the wearing properties is case hardened in the region of the groove. The thread guide is mounted to slide on a round rod which is positioned parallel to the axis of the cylinder. The upper surface of the thread guide contacts and is guided by the cover for the cam which is mounted on the front of the machine and extends over said cam. The guide also
carries a cam follower which cooperates with the
83 groove in the cam to cause the guide to move back
and forth to lay the thread on the package in layers
of reversed spiral windings. The cam is driven by means of friction rings mounted at each end thereof and contacting the drive roll of the machine.

References:
Jones (Br.) 108,407 Aug. 9, 1917
Voight (Br.) 2,102 of 1901
Foster 459,039 Sep. 8, 1891
Rhoades 867,153 Sep. 24, 1907
Abbott et al. 1,700,425 Jan. 29, 1929

Claims 8 to 10, inclusive, 37 and 38 are rejected as not defining any invention over Jones, Foster or Rhoades. Jones shows a cylindrical cam with the intersecting grooves on its surface for moving the thread guide to traverse the thread on the spool. Foster and Rhoades both show the cam and guide arrangement similar to the applicant's. The claims are directly readable on the structures of Jones, Foster and Rhoades with the exception of the statement that the cam is case hardened in the region of the groove. It is held that such a change would obviously be within the skill of a mechanic and does not define any invention over the references. Case hardening has long been used in all mechanical fields where a wear resisting surface is needed. The applicant presented an affidavit relative to this feature (paper No. 18) which has carefully been considered. This affidavit clearly sets forth the applicant's problem which required a better wear surface but there is nothing contained therein which shows that this well-known method of hardening would not be obviously used when a better wear surface was needed.

84 Claims 26 and 28 are rejected as not defining any invention over Voight in view of Foster or Rhoades. Voight shows a traverse cam, a slider moved to and fro by the cam, a support 1 for the slider, a cover plate for the cam engaging the slider and a guide eye on the slider. Foster and Rhoades both show it to be old to support the slider on a round rod. It is held that it would not involve any invention to use round rod as shown in Foster or Rhoades to support the slider of Voight in place of the support 1.

Claims 34 to 36, inclusive, are rejected as not defining invention over the invention claimed in Abbott et al. These claims are very broad. Abbott et al. very clearly shows in Figs. 3 and 4 the cam with the driving flanges or friction tractor rings 121 of metal which contact the drive roll of the machine and drive the cam as it slides along said roll during the movement of the winding unit there along. Attention is called to claim 14 of the patent. Claim 34 broadly calls for a "resilient" tire. This is clearly met by the reference. Claims 35 and 36 are drawn to cork and rubber as specific materials for the friction rings. The resilient and frictional properties of these materials are well-known. It is held that the use of these well-known friction materials as drive rings for the cam does not make the claims patentable over the invention claimed in the patent.

In view of the above arguments it is submitted that these rejections should be sustained.

G. E. PARKS
Examiner, Div. 61.

Copy mailed to:

ROBERTS, CUSHMAN & WOODBERRY
31 Milk Street
Boston Massachusetts

J. T. K.

85 Endorsed: U. S. Patent Office Board of Appeals Aug 2-1935 Mailed

Appeal No. 14,188
Paper No. 25
Decision.
VFM

Appeal No. 14,188
Hearing:
July 24, 1935

In the United States Patent Office

Before the Board of Appeals

Ex parte Edward J. Abbott

Application for Patent filed January 5, 1931, Serial No. 506,530. Winding Machine.

Messrs. Roberts, Cushman & Woodberry for applicant.

This is an appeal from the final rejection of claims 8 to 10, inclusive, 26, 28 and 34 to 38, inclusive.

Claims 8, 26 and 34 are illustrative.

8. A winding machine traverse device for laying a winding strand into layers of reversed spiral windings, including a rotary cylinder having a traversing groove therein, the groove including right and left hand spiral portions crossing each other at least once, said cylinder being of steel case-hardened in the region of the said groove.

26. In a winding machine for yarn and the like, the combination of a traverse cam, a slider adapted to be traversed to and fro by the cam, a round guide rod on which the slider slides, the slider having a portion extending laterally of the guide rod in the direction of the winding mass of yarn and carrying a yarn-engaging element, and a cover plate for the cam disposed to contact with the said laterally extending portion of the slider adjacent to the
85a yarn-engaging element.

34. A textile machine comprising a traverse cam, a tractor roll for driving the cam, and a resilient tire on the cam adapted to contact with the tractor roll.

The references relied upon by the examiner are as follows:

Voight (British)	2,102	Mar. 23, 1901
Foster	459,039	Sep. 8, 1891
Rhoades	867,153	Sep. 24, 1907
Jones (British)	108,407	Aug. 9, 1917
Abbott et al	1,700,425	Jan. 29, 1929

Appellant presents a winding machine traverse device for laying a winding strand in layers of reversed spiral windings. There are three novel features to which our attention has been directed, recited in the rejected claims which are urged as rendering the old style winding machine of this character much more efficient and speedy in operation. First, the cam cylinder is made of a steel case-hardened in the region of the cam grooves. The patents to Jones, Foster and Rhoades all disclose the same type of cam cylinder but not case-hardened at the grooves. It is pointed out by the examiner that such case-hardening has long been used where a wear resistant surface is needed and that fact is not disputed. Appellant's contention is, that by forming this cam cylinder of case-hardened steel it wears much better and therefore allows of greater commercial speed of operation. This is claimed to be a matter involving invention. We do not consider it so. The selection of case-hardened steel in place of cast iron or other types of material is certainly obvious to provide against excessive wear.

Appellant argues at some length that this style of winding machine has been operated slowly for many years
86 to avoid excessive wear on this cam and this type
of machine with a slider thread guide has been discarded commercially and another type, more speedy but much less satisfactory in other respects, substituted in certain fields. Even conceding this to be true and we have no reason to dispute the statement, we still think this case-hardening feature is not a patentable advance in the art. If we held such feature patentable, why not the *case-hardening* of other parts subject to wear? Again, if it is a matter of speeding up the machine, would it be invention to substitute as a driving motor a more modern high speed motor for that formerly used? The answer is clearly no. In our opinion it is not a question of increase in speed, but providing against excessive wear which appellant has solved by the substitution of a well known metal for this purpose.

Other claims, as for instance claim 27, recites as an additional feature of invention the use of a cover plate for the cam as a guide for the slider cooperating with the cam, the slider being mounted on a round guide rod. In our opinion this arrangement is within the skill of the designer of the machine and requires no inventive genius. The examiner points to the patent to Voight in which the slider guide is mounted between parts forming a casing for the cam roller. The slider is not mounted on a round rod but round rods for the support of sliders are old in the art. See patents to Foster and Rhoades. It is our view that to arrange the cover plate as a guide for the slider would be more or less obvious if thought desirable.

87 Other claims, such as claims 34 to 36, call for a resilient tire on the cam, the tire being formed of cork or rubber. In the Abbott patent a similar tire is formed of "soft metal". The examiner holds and we think properly, the substitution of cork or rubber for soft metal as a suitable friction ring to cooperate with a driving friction roll is not so unobvious as to amount to invention. Appellant claims it is not obvious that such rubber or cork would slide along a cooperating friction roll. In our view this depends entirely upon the character of rubber and cork and with certain types of cork and rubber, it would be obvious.

The decision of the examiner is affirmed.

BOARD OF APPEALS

BRYAN M. BATTEY
Assistant Commissioner

E. T. MORGAN
Examiner-in-Chief

J W CLIFT
Examiner-in-Chief

August 2, 1935

88 Endorsed: Approved by EB Revised by ....
Letter No. 127487 Date 10/5/37

Pl Ex 1-a
JR

390

DEPARTMENT OF COMMERCE

UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of the Original Drawings, in the matter of the

Pending Application of

Edward J. Abbott,

Filed January 5, 1931, Serial Number 506,530,

for

Improvement in Winding Machine.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-first day of October, in the year of our Lord one thousand nine hundred and thirty-seven and of the Independence of the United States of America the one hundred and sixty-second.

ATTEST:

Chief of Division.

Conway P. Coe

Commissioner of Patents.

11—6036
U.S. GOVERNMENT PRINTING OFFICE

Ad 242/18

73

506530 X DIV. 61

3 Sheets-Sheet 1

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O. G. FIG.

CLASS

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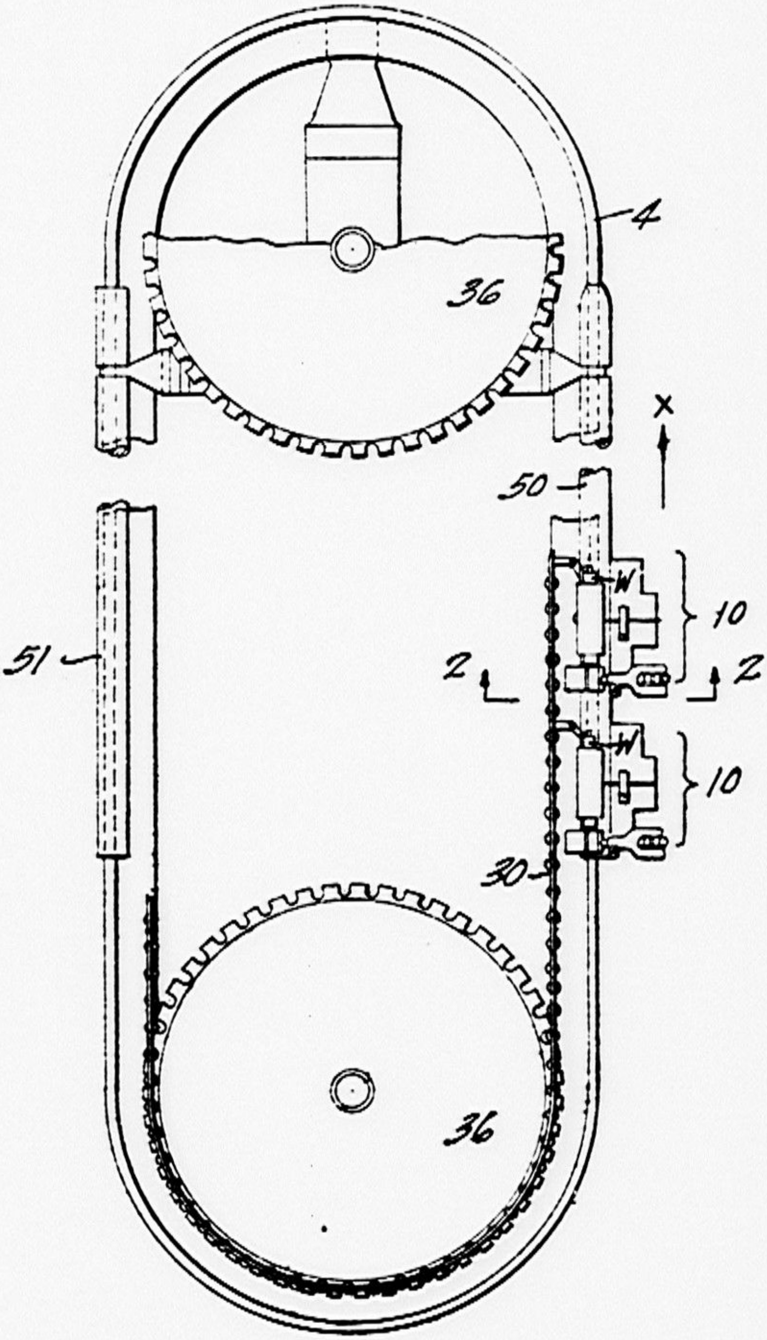
Fig. 1



INVENTOR
EDWARD J. ABBOTT
by Roberts, Cushman & Woodberry.
HIS ATT'YS

75

Serial No. 506530 DIV. 61
3 Sheets-Sheet 2

Fig. 3

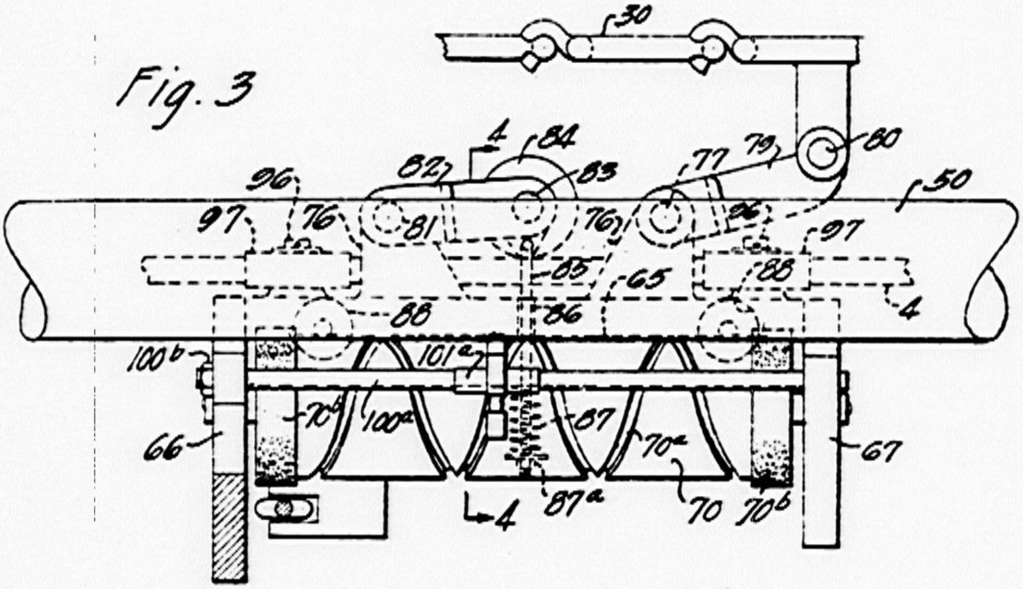


Fig. 4

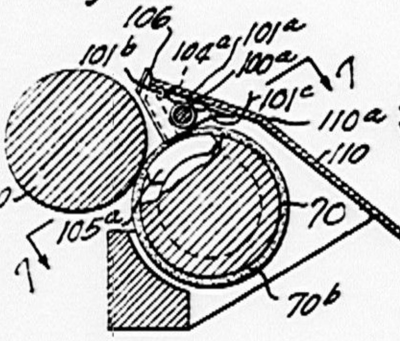


Fig. 2

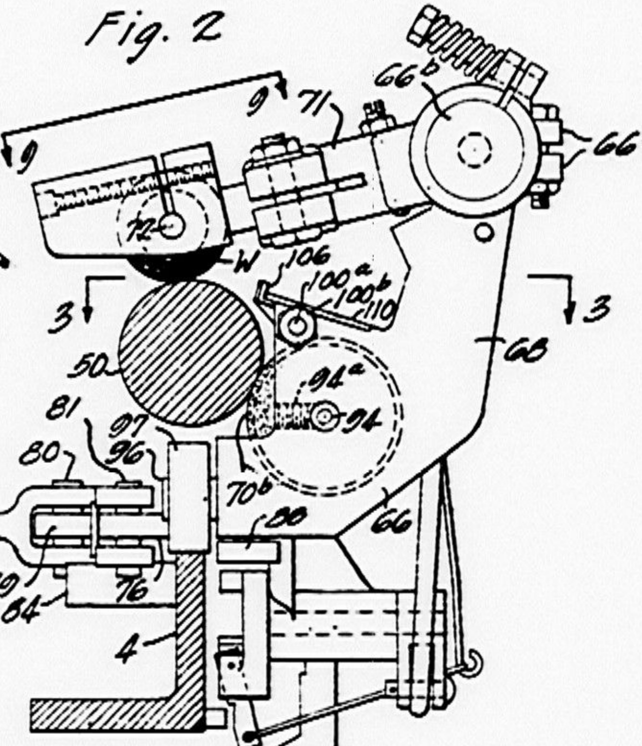
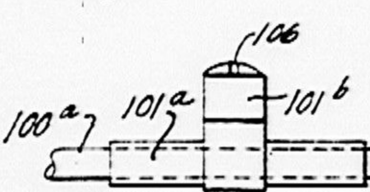


Fig. 5



INVENTOR
EDWARD J. ABBOTT
by Roberts, Cushman & Woodberry
HIS ATT'YS

506530

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Fig. 7

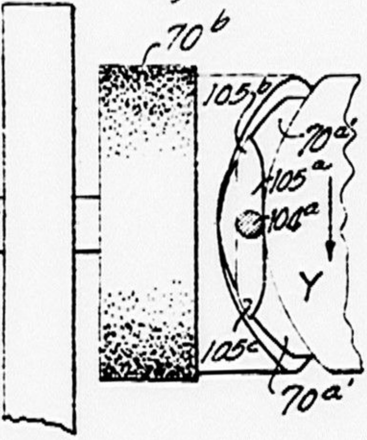


Fig. 7a

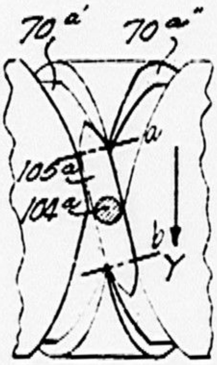


Fig. 7b

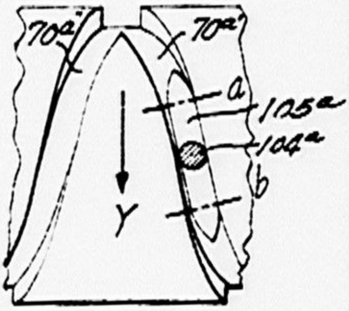


Fig. 6

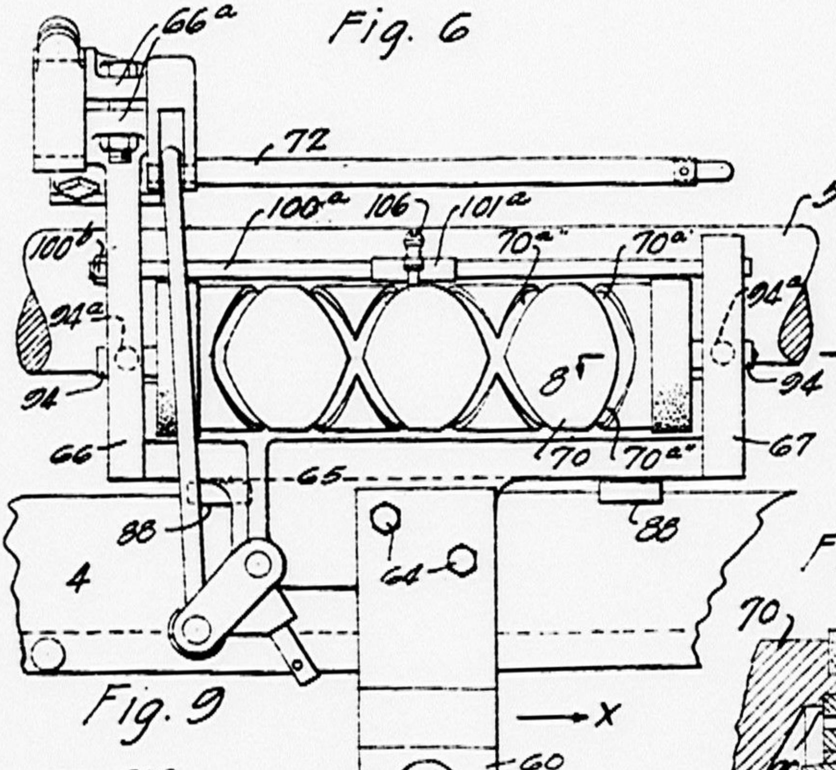


Fig. 8

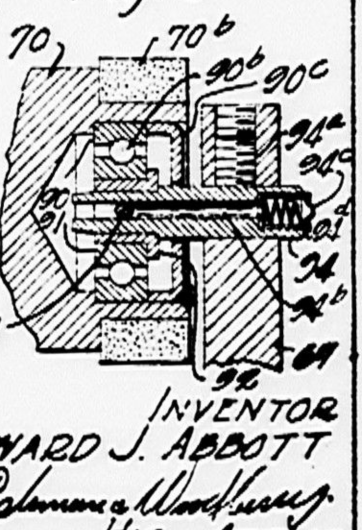
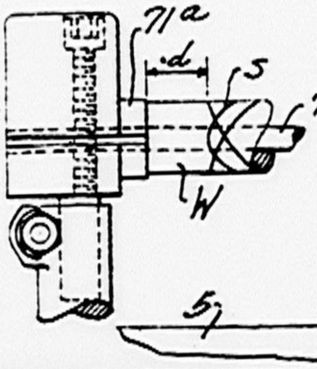


Fig. 9



INVENTOR
EDWARD J. ABBOTT
by Roberts Cushman & Woodberry
HIS ATTYS

(No Model.) 2 Sheets—Sheet 1.

J. W. FOSTER.

YARN OR THREAD WINDING MACHINE.

No. 459,039. Patented Sept. 8, 1891.

Fig. 1.

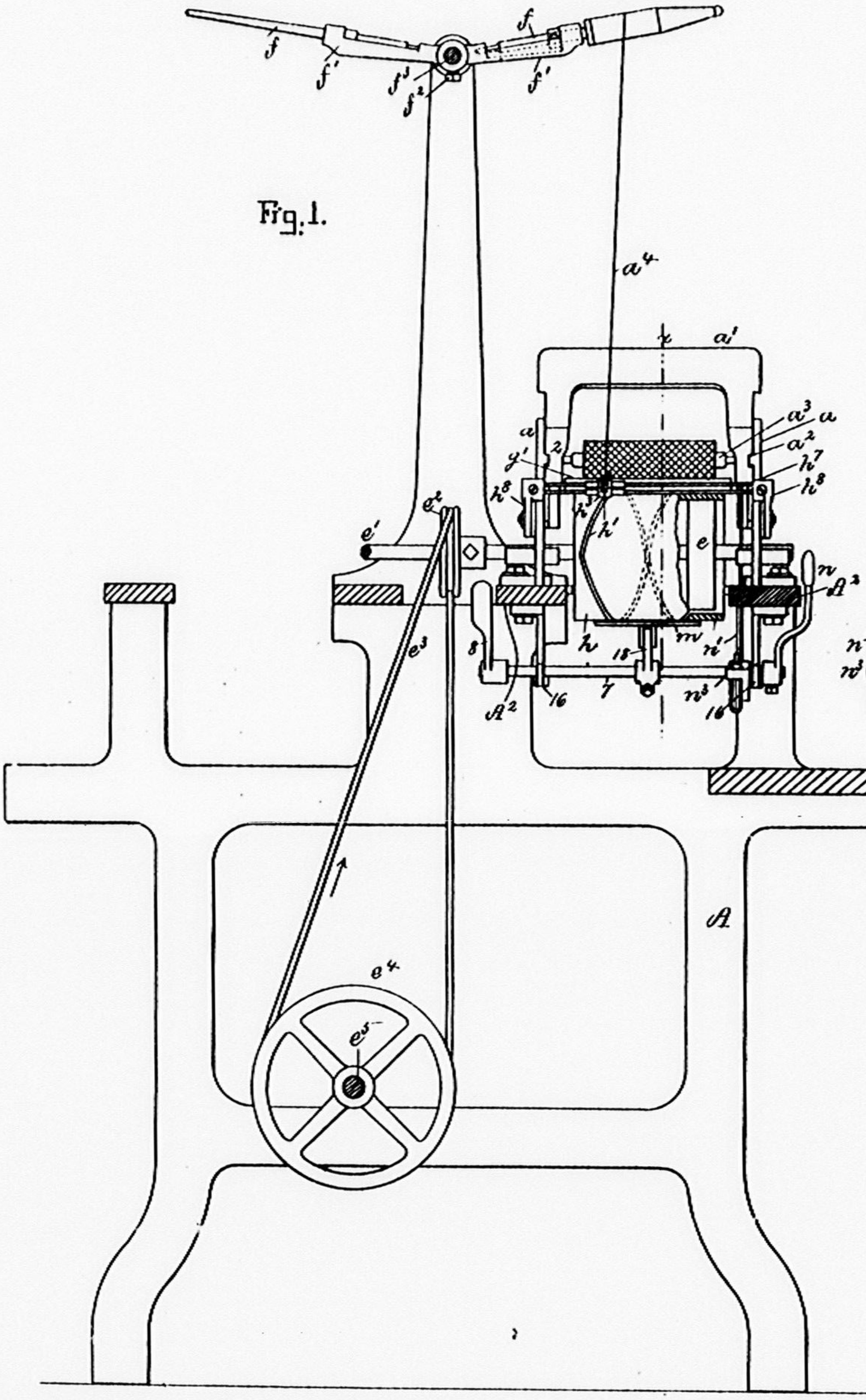
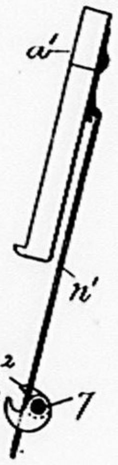


Fig. 9.



Witnesses.

Fred. S. Greenleaf

John F. C. Prinkert

Inventor

John W. Foster.

by Crosby & Gregory Attys.

(No Model.) 2 Sheets—Sheet 2.

J. W. FOSTER.

YARN OR THREAD WINDING MACHINE.

No. 459,039. Patented Sept. 8, 1891.

Fig. 2.

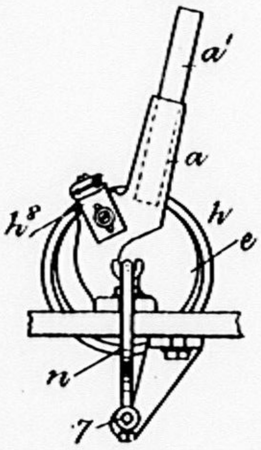


Fig. 3.

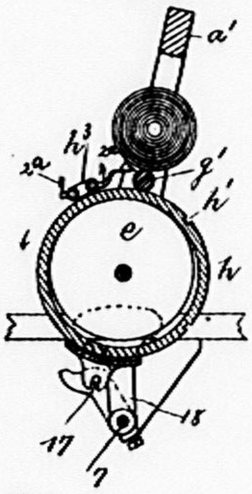


Fig. 4.

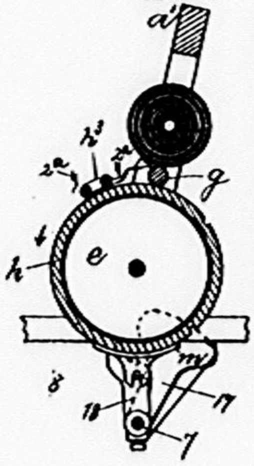


Fig. 5.

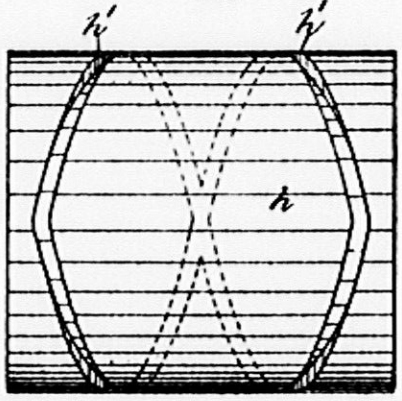


Fig. 6.

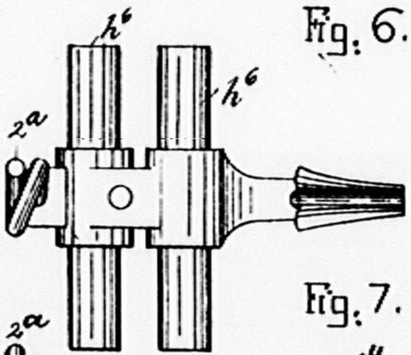


Fig. 7.

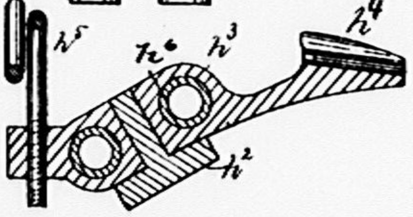


Fig. 7a.

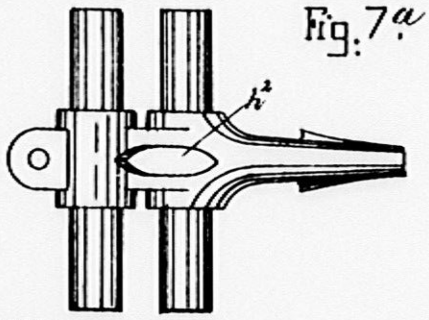
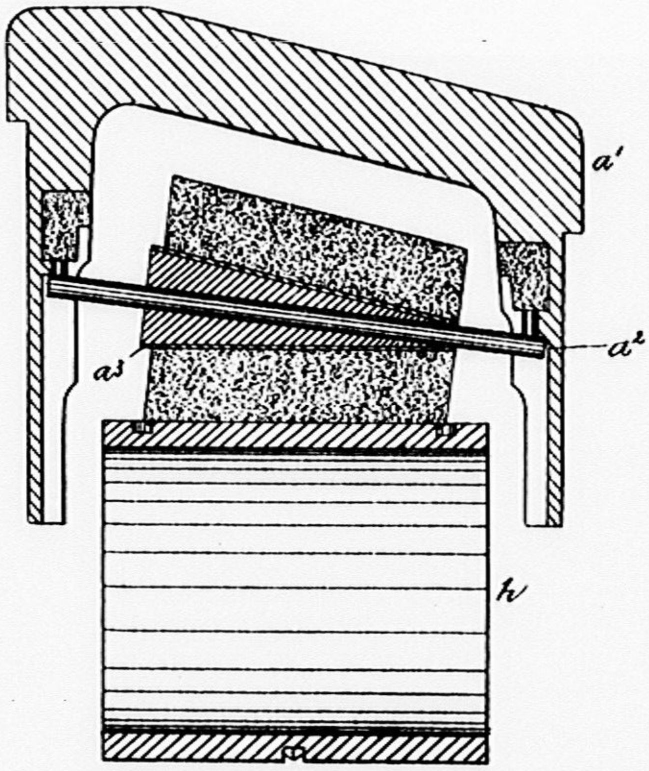


Fig. 8.



Witnesses.

Fred. S. Greenleaf

John F. C. Preinkert

Inventor.

John W. Foster.

by Crosby & Gregory attys.

UNITED STATES PATENT OFFICE.

JOHN W. FOSTER, OF FALL RIVER, MASSACHUSETTS.

YARN OR THREAD WINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 459,039, dated September 8, 1891.

Application filed July 1, 1890. Serial No. 357,331. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. FOSTER, of Fall River, county of Bristol, State of Massachusetts, have invented an Improvement in Yarn or Thread Winding Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention has for its object the production of a machine for spooling both yarns and glazed threads, my invention being applicable to both classes of winding.

The machine herein to be described is an improvement upon that represented in my United States Patent No. 436,521, dated September 16, 1890, the said patent containing a shell-roll, the rotation of which is quickly stopped by lifting it from contact with a roll or driving-wheel within it.

In this present invention I have so grooved the said shell-roll as to cause it to actuate the traverse device, there being a traverse device for each spool being wound.

In this machine the yarn or thread will be wound directly upon a receiver, which may be a paper tube or cone, as desired, or a wooden hub. When the receiver is a paper or other hollow tube, the said receiver will be sustained upon an iron rod, the ends of which are acted upon by a yoke which is adapted to slide vertically, or nearly so, in a suitable guide as the diameter of the yarn or thread upon the said receiver increases, owing to the addition of yarn or thread thereto.

When my machine is to be used for winding glazed threads, it is very essential that the thread-guide of the traverse device be carried close to the point of contact of the thread with the shell or other rotating device which rotates the receiver and the mass of thread thereon. So to provide for this I place between the shell-roll and the receiver upon which the thread is to be wound an intermediate driving-roll, which need not be more than about an inch in diameter; but the said roll is, however, not necessary when winding common yarns, although it can be used, if desired. The driving-roll is especially necessary when winding glazed thread, because, unless the nose of the guide of the traverse device lies close to the mass of thread on the receiver being wound, the thread, at the change of direction of the traverse device, will slip off the end of the mass of thread, so that the ball will not be properly wound at the ends. The yarn or thread to be wound in spool form is taken from cops of yarn or thread mounted upon spindles or bobbins arranged, preferably, in nearly horizontal position substantially parallel to the axis of rotation of the receiver to receive the yarn or thread, so that the said yarn or thread comes down in a substantially straight line from the cop or bobbin to the traverse device.

One part of my invention consists in an organized spooling-machine containing a shell-like driving-roll having a crossing groove in its periphery, combined with a thread-traversing device actuated by the said crossing groove to lay the yarn or thread from end to end of a ball deriving its rotation from the said shell-roll.

Other features of my invention will be hereinafter described, and pointed out in the claims at the end of this specification.

Figure 1 of the drawings is a sectional detail showing a sufficient portion of a spooling-machine, taken in connection with my application referred to, to enable my present invention to be understood. Fig. 2 is a detail showing the shell-roll, the driver for it, and one of the stands, and the rods on which the traverse device is made to slide. Fig. 3 is a section in the line x of Fig. 1, the lifting device for the shell-roll being down in the position it will occupy when the shell-roll is being rotated. Fig. 4 is a like section with the shell-roll elevated and at rest. Fig. 5 is an enlarged detail of the shell-roll, showing its crossing groove. Figs. 6, 7, and 7^a are detail views in different positions of the traverse device enlarged, the latter being an under side view. Fig. 8 is a modification of my invention, wherein the machine is adapted to wind a conical ball instead of a cylindrical ball, as in Figs. 1 to 8. Fig. 9 is a detail showing the vertically-movable yoke and its connection to actuate the rock-shaft to raise the shell-lifting device and shell to stop its rotation.

The frame-work A has suitable sills A^2

running lengthwise thereof, on or to which are connected the devices for supporting the chief working parts.

The shaft e^5, the pulley e^4 thereon, the belt e^3, extended over the pulley e^2 on the shaft e', provided with the wheels or disks e, the bearings for the said shaft e', the depending bracket 16, the rock-shaft 7 therein provided with a handle n, by which to turn it when desired, the arm 18, connected with said shaft and having a pin 17, which serves to receive and support the lifting device m, shown as a concaved bar adapted to fit the under side of the shell-roll h, are and may be all substantially as in my said patent, it being understood that in practice the said rock-shaft 7 will, as in the said patent, be provided with an arm to be acted upon by a suitable stop-motion device whenever the yarn or thread fails, so as to turn the said rock-shaft automatically in a direction to raise the lifting device m against and so as to lift the shell-roll and stop the rotation of the shell-roll.

The sills A^2 have erected upon them pairs of standards a, there being one such standard at each end of each shell-roll, the said standards being grooved at their inner sides (as best shown by dotted lines, Fig. 2) to receive the lower ends 2 of a yoke a', having suitable shoulders to bear upon the iron rod a^2, upon which is placed the receiver a^3, upon which is to be wound the yarn or thread a^4 to constitute a cylindrical or conical ball, as in Figs. 1 and 8. In Fig. 1 the receiver is intended to be represented as a paper or other tube cylindrical in form, while in the modification, Fig. 8, the tube is conical in form and is sustained upon a conical hub.

The shell-roll h is like the shell-roll described in the said patent, with the exception that herein it is provided with a crossing groove h', in which enters a traveler h^2, pointed at both ends and mounted loosely upon the body h^3 of the traverse device, it having a delivery-nose h^4 suitably grooved for the passage of the yarn or thread, the yarn coming through the said nose from suitable thread-guides 2^a. The traverse device is shown as having two sleeves h^6, which are adapted to slide upon parallel rods h^7, the ends of which are suitably held in stands h^8, secured in a suitable manner to the stand a.

The weight 8, fast to the rock-shaft 7, is so placed as to aid in turning the said shaft to actuate the lifting device m as soon as the shaft 7 is turned by a depending loop or link n', attached to the yoke a' and extended through between arms n^2 and n^3 of a collar attached to the rock-shaft 7, the said link meeting the arm n^2 as soon as the ball is of the desired diameter to thus start the rock-shaft 7, the weight 8 completing its movement to elevate the lifter and lift the shell-roll from the driving-wheels e, the arm n^3 preventing the escape of the link from the said collar.

The yarn to be spooled is taken from a suitable cop or bobbin on a spindle f, arranged in nearly horizontal position in a bolster f', having suitable bearings for the central part of the spindle and for the step, the said bolster being attached at its lower end by a suitable set-screw f^2 to a rod f^3, so that the yarn or thread a^4 can pass vertically to the guide-eye 2^a of the traverse device.

I do not desire to limit this invention to the exact form of the spindle, as the gist of this part of my invention lies in placing the spindle in a nearly horizontal position, so that the thread may pass directly to the thread-guide of the traverse device without passing through other guides, thus saving strain and friction upon the threads.

For winding glazed thread the yoke receives within it the journals of a small auxiliary driving-roll g', which rests directly upon the surface of the shell-roll, so that the said roll is rotated by frictional contact with the shell-roll whenever the shell-roll is rotated. The receiver upon which the yarn is to be wound and the ball made by the yarn upon the receiver rest directly upon the periphery of the intermediate driving-roll and are rotated by frictional contact with it. By employing this small intermediate driving-roll it is possible (see Fig. 3) to place the delivery-nose h^4 of the traverse device substantially at the bight or point of contact of the receiver or yarn thereon with the intermediate driving-roll, so that the thread is held close up to the point at which it is wound in the mass, and thereby the thread is prevented from slipping off the end of the ball, which would produce imperfect winding. When the receiver or ball rests directly upon the shell-roll, the nose of the traverse device cannot hold the yarn as closely to the ball as when the small intermediate roll is employed; but for coarser yarns this intermediate roll may be omitted.

It will be understood that the yoke a' rises as the mass of yarn or thread on the receiver increases in diameter.

The intermediate roll g' may be covered or be a plain uncovered roll, as desired, and the covering may be of any usual character.

I claim—

1. The driving wheels or disks, the shell-roll grooved at its periphery, and a traverse-guide actuated thereby to traverse the material to be wound from one to the other end of the ball, substantially as described.

2. A rotating roll provided with a crossing groove and a traverse-guide actuated thereby, combined with a shaft for a hub or shell on which the material is to be wound in a ball and a yoke which is elevated by the said shaft as the ball increases in diameter, substantially as described.

3. The rotating roll h, provided externally with a crossing groove, a traverse-guide actuated thereby, a shaft to support the hub or shell on which the material is to be wound, and a yoke to bear on the said shaft, combined with an intermediate roll g', to operate substantially as described.

4. The rotating shell-roll having a crossing groove, a driving-roll therein, a lifting device to lift the shell-roll, a rock-shaft by which the lifting device is actuated, a yoke, a traverse-guide, a weight, and means between the said yoke and shaft to rotate the latter, substantially as described.

5. The driving wheels or disks, the shell-roll grooved at its periphery, and a traverse-guide actuated thereby to traverse the material to be wound from one to the other end of the ball, combined with a delivery-spindle *f*, arranged substantially as described to enable the thread to be laid directly from the spindle to the guide-eye of the traverse-guide, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN W. FOSTER.

Witnesses:
GEO. W. GREGORY,
EMMA J. BENNETT.

(No Model.)

J. W. FOSTER.

SPOOLING MACHINE.

No. 473,417. Patented Apr. 19, 1892.

Fig: 1.

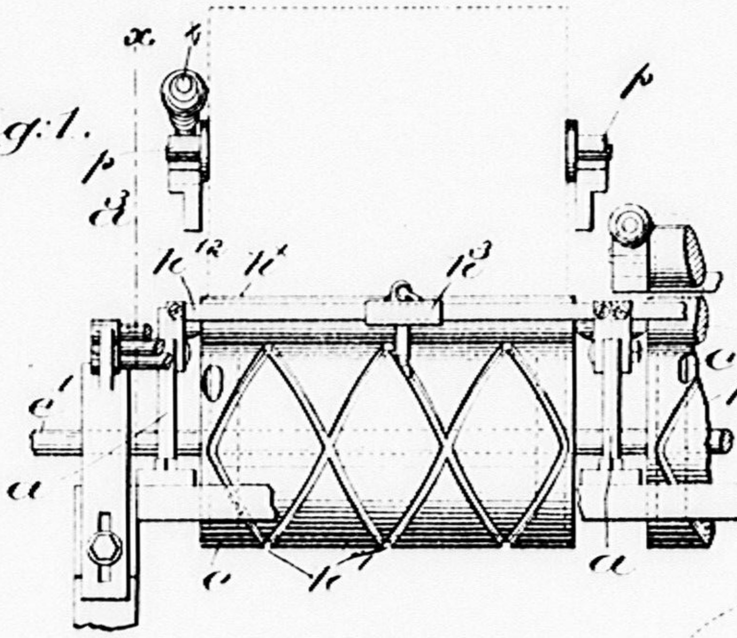


Fig: 5.

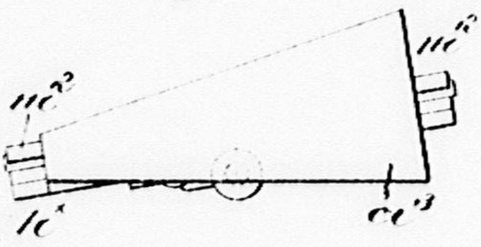


Fig: 2.

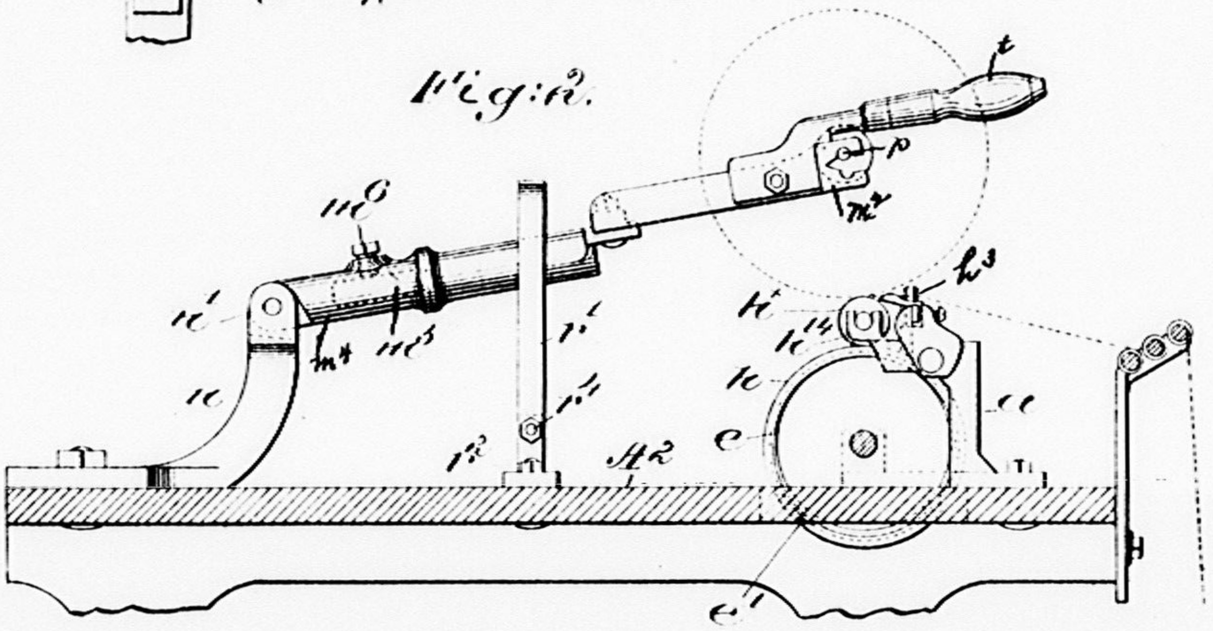


Fig: 3.

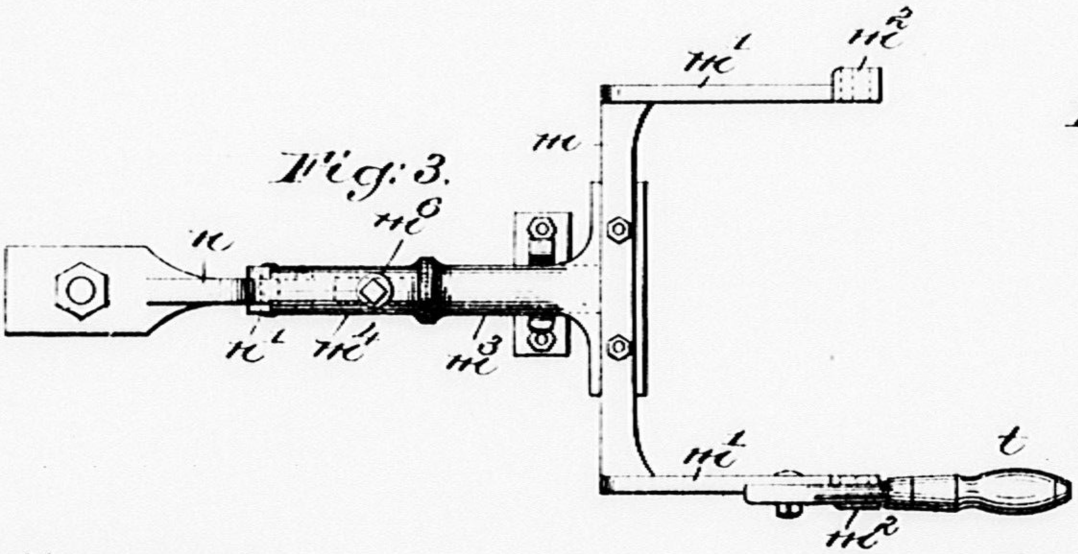
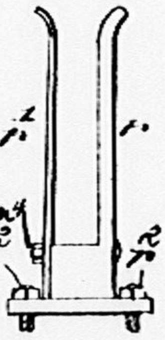


Fig: 4.



Witnesses.
Edward F. Allen
Emma J. Bennett

Inventor
John W. Foster.
by Crosby & Gregory
attys.

UNITED STATES PATENT OFFICE.

JOHN W. FOSTER, OF WESTFIELD, MASSACHUSETTS, ASSIGNOR TO THE FOSTER MACHINE COMPANY, OF SAME PLACE.

SPOOLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 473,417, dated April 19, 1892.

Application filed January 20, 1892. Serial No. 418,675. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. FOSTER, of Westfield, county of Hampden, State of Massachusetts, have invented an Improvement in Spooling-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

United States Patents Nos. 459,039 and 459,040, granted to me September 8, 1891, show and describe apparatus for winding masses of thread or yarn, the first upon a quill and the latter upon a cone, the journals of the roll holding the quill and also of the roll holding the cone having co-operating with them a vertically-sliding weighted yoke. In the said patents the series of shell-rolls, one for each spool or cone upon which the yarn or filamentous material was wound, were arranged side by side and parallel each to the other; but herein I have provided to arrange the shell-rolls end to end, or substantially so. In my efforts to better adapt spooling-machinery, preferably such as represented in said patents, to holding and controlling the journals carrying the quill or a cone upon which the yarn is being wound, so that the mass of yarn shall be kept down properly upon the winding-roll or device interposed between the quill or cone on the one side and the shell-roll on the other side, I have provided a yoke of peculiar construction, said yoke being so made as to support and carry the said journals so that by lifting the yoke the journals will be lifted and the spool or cone be elevated out of contact with relation to the driving-roll of whatever form, such as provided for in said patents. This yoke, in order that it may be readily elevated, is provided with a handle, and with the yoke I have combined a friction device to prevent the too-free rising of the yoke during the winding operation. The friction device, for the best results, will have one arm or part adjustable with relation to the other arm or part, and preferably one part will be made as a spring, so as to regulate the friction. The yoke referred to is mounted upon a pivot, which is parallel, or substantially so, to the axis of rotation of the driving-roll referred to, so that the free end of the yoke having the bearings to support the journals used to sustain either the quill or the cone may rise and fall, and also the said yoke will have a suitable swivel-joint between the bearings and the pivot referred to, so that the part of the yoke containing the bearings referred to may tip about a pivot or center substantially at right angles to the center of rotation of the driving-roll, adjustment of the portion of the yoke containing the bearings as last referred to enabling either a quill or a cone to be readily supported by the yoke and yet be presented properly with relation to the driving-roll.

My invention consists in the combination, in a spooling-machine, with a yoke provided with bearings adapted to not only rise and fall about a horizontal pivot parallel with the axis of rotation of the driving-roll, but also to rock or tip at right angles to the axis of rotation of the said driving-roll, of an adjustable friction device co-operating with said yoke, and means to adjust said device to vary the friction, to operate substantially as will be described.

Figure 1 in front elevation represents a sufficient portion of a spooling-machine containing my improvements to enable my present invention to be understood. Fig. 2 is a view taken to the right of the dotted line x, Fig. 1. Fig. 3 is a top or plan view of the yoke alone; Fig. 4, a front elevation of the friction device and yoke-guide; Fig. 5, a front end view of the yoke shown as supporting a cone instead of a quill or spool or bobbin.

Referring to the drawings, let it be supposed that the shaft e' is extended from end to end of a spooling-machine, and that it has on it a series of sets of disks e, which receive over them loosely a series of hollow shell-rolls h, the latter hanging by their weight upon the disks, and in such condition being rotated thereby, the shell-rolls having suitable crossing or endless grooves h' to receive a stud or pin projecting from a traverse-guide h^3, provided with an eye to receive the thread or filamentous material which is to be wound, the said shell-roll acting to reciprocate the said traverse-guide upon suitable guide-rods h^{12}, held at their ends in suitable stands a, erected on a top plate or table A^2. Resting upon the shell-roll is a driving-roll $h^{\times}$, having its journals laid loosely in a bearing h^{14}, supported by the stands a.

The parts so far described and referred to by letter are substantially the same as in the patents cited as to their operation, and in practice the shaft c' may be rotated in any usual or suitable manner adapted to spooling-machines, and the shell-roll will have working with it a brake-shoe or lifting device, substantially as provided for in the said patents, but not herein shown, which when the mass of yarn is of proper diameter or the thread breaks will cause the shell-roll to be lifted from contact with the disks, thus immediately stopping the rotation of the shell-roll and the winding operation.

As to the driving-roll (designated by the letter h^x) it, when a quill is to be wound so as to make a cylindrical mass of thread or filamentous material, will preferably be cylindrical in form, and the periphery of the said driving-roll for that work may be in one single piece; but when a cone or conical mass of thread or filamentous material is to be wound then the driving-roll will be of the form provided for in United States Patent No. 459,040, wherein the driving-roll is shown and described as made up of a series of loose rolls or sections, so as to avoid undue friction upon the yarn mass, which varies in diameter and consequent surface speed from end to end.

I will now describe my improved yoke. Erected upon the table A^2 is a stand n, which supports a pivot n', which is located parallel, or substantially so, to the axis of rotation of the driving-roll h^x. The yoke referred to as one of the chief features of this present invention is composed of a part m, having arms m' m', provided with suitable bearings m^2, the part m having a rearwardly-extending portion m^3, which is pivoted, jointed, or articulated with relation to the part m^4 of the yoke, so that the part m may tip or turn on or with relation to the part m^4 about a pivot substantially at right angles to the center of rotation of the driving-roll. In this present instance of my invention the articulation referred to has been effected by a projection m^5 (shown by dotted lines) of the part m^3 entering a hole or longitudinal central opening in the part m^4, a screw m^6 co-operating with the extension or pivot m^5, retaining the portion m, having the bearings m^2, in proper position with relation to the part m^4 of the yoke, which is free to rise vertically about the horizontal pivot n' referred to. When a quill is to be wound with a cylindrical mass of thread, either a paper or other quill of any usual or suitable form is provided in the usual manner with journals p, which are mounted in the bearings m^2, and the part m of the yoke is so adjusted with relation to the part m^4 that the center of rotation of the quill and its journals p will be substantially parallel to the center of rotation not only of the driving-roll h^x, but also of the shaft c'; but when a cone or a conical mass of thread or filamentous material is to be wound, then a cone, substantially such as provided for in said Patent No. 459,040, or as shown in Fig. 5, will have its journals mounted in the bearing m^2 of the yoke, and the screw m^6 will be loosened, so as to let the portion m of the yoke be tipped about a pivotal point or center substantially at right angles to the center of rotation of the driving-roll, so that the cone can take proper bearing upon the driving-roll of whatever form, preferably such a driving-roll as provided for in Patent No. 459,040.

In practice the portion m^3 of the yoke is placed between the jaws r r' of a friction device suitably attached to the table-plate A^2 by suitable screws r^2, one of the arms r' being preferably of spring metal and being adjustably attached to the block or stand, to which is connected the arm r, so that by or through a suitable nut or screw r^4 the arm r' may be adjusted toward or from the arm r. This friction device, by pinching the portion m^3 of the yoke, acts as and performs the duty of the weight provided for in the last-mentioned patent, and also obviates jarring due to the rapid motion of some of the parts, and the friction of the friction device upon the yoke has to be overcome as the mass of thread is being wound and the yoke rises. By the adjusting means the friction can be varied, as desired. I have provided the yoke with a handle t, which may be engaged by hand whenever it is desired to quickly lift the bearing end of the yoke to elevate the mass of wound thread or filamentous material from the driving-roll or for any other purpose in the operation of the parts.

Having described my invention, what I desire to claim and secure by Letters Patent is—

1. The combination, with a driving-roll to act on and rotate a quill or cone upon which is to be wound filamentous strands, of a yoke having a pivot substantially parallel with the center of rotation of the driving-roll and also a pivot substantially at right angles to the center of rotation of the driving-roll, an adjustable friction device co-operating with said yoke, and means to adjust said device to vary the friction, substantially as described.

2. In a spooling-machine, the combination, with a yoke provided with bearings adapted to rise and fall about a horizontal pivot parallel with the axis of rotation of the driving-roll and also to rock or tip at right angles to the axis of rotation of the said driving-roll, of an adjustable friction device co-operating with said yoke, said device comprising a fixed and a movable friction-jaw between which the yoke is held, and means to move the jaws toward or from each other to operate substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

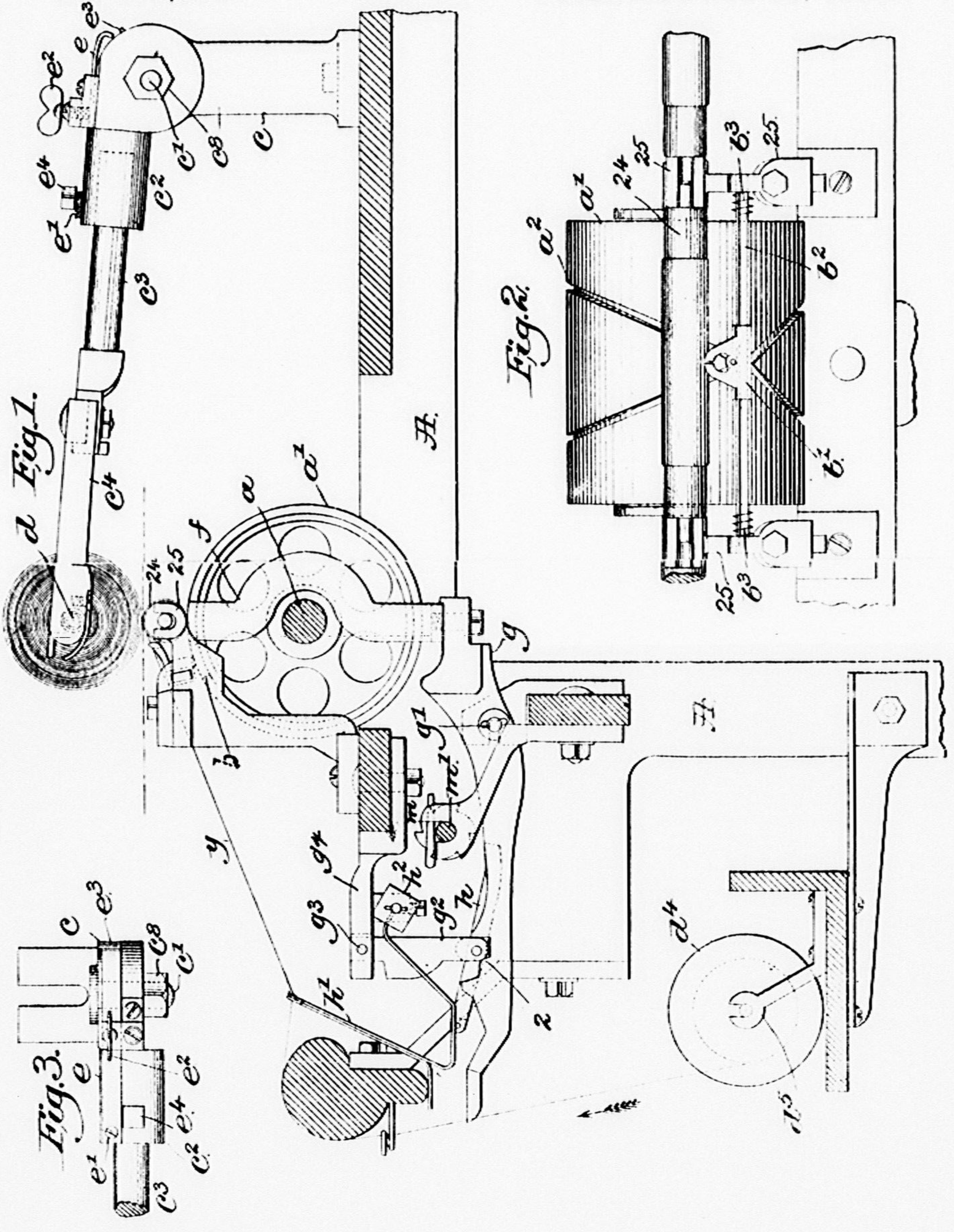
JOHN W. FOSTER.

Witnesses:
ALFRED F. LILLEY,
JAMES NOBLE, Jr.

(No Model.)

J. W. FOSTER.
SPOOLING MACHINE.

No. 499,668. Patented June 13, 1893.



Witnesses.
Louis N. Gowell
Emma J. Bennett

Inventor;
John W. Foster.
By Crosby & Gregory Attys.

UNITED STATES PATENT OFFICE.

JOHN W. FOSTER, OF WESTFIELD, MASSACHUSETTS, ASSIGNOR TO THE FOSTER MACHINE COMPANY, OF SAME PLACE.

SPOOLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 499,608, dated June 13, 1893.

Application filed December 12, 1892. Serial No. 454,911. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. FOSTER, of Westfield, county of Hampden, State of Massachusetts, have invented an Improvement in Spooling-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention has for its object to improve and simplify the construction of spooling machines, my improved machine being adapted to wind yarn on tubes either conical or tubular.

The tube to be wound, of whatever shape, is mounted on a spindle having its journals mounted in bearings on a yoke forming part of an arm mounted to turn about a horizontal pivot. The spindle or tube rests on a roll driven by a drum which, as herein constructed, has a crossing groove to actuate a suitable traverse guide, the yarn going to the spindle being acted upon by a drop wire which co-operates with part of a stop motion and effects the lifting of the roll from the drum and the consequent stopping of rotation of the roll whenever the yarn breaks.

Prior to my invention I have described in United States Patent No. 404,831, granted June 11, 1889, a series of rotating cylinders upon which rest drums of the same diameter, said drums acting to rotate spools held between suitable spool holders so shaped as to let the journals of the spool carrying disks rise in a slot during the winding operation, the traverse of the thread being effected by a heart cam on a shaft in the upper part of the machine.

In this my present invention, the thread is wound upon a tube carried by a spindle having its bearings in a carrier or holder which is pivoted at a distance from the winding roll which rotates it, and the winding roll which is rotated by the drum has imparted to it many rotations to each rotation of the drum, and the drum is made the driving member of the thread laying finger or traverse mechanism.

Figure 1 is a partial cross sectional view of a sufficient portion of a spooling machine to illustrate my invention; Fig. 2, a detail showing in plan or top view a driving drum, roll and traverse device, and Fig. 3 is a detail to be referred to.

The frame work A is and may be as usual in spooling machines, it being of suitable shape to sustain the working parts.

The machine in practice will or may have at each side a suitable longitudinal shaft as a, provided at suitable distances apart with like drums a', one for each spool, said drums having suitable crossing grooves a^2 in which enters a foot or shoe b of a traverse guide b' mounted to slide freely on a guide rod b^2, suitable springs b^3 on the rod acting as buffers, as the traverse guide eye completes its stroke, the rotation of the drum rotating the roll 24 lying on it loosely, said roll having its journals mounted in open bearings of stands 25.

The frame-work has in practice a series of suitable stands c, upon each of which is pivoted, as at c', a holder c^2 for the shank c^3 of a yoke or carrier c^4 having suitable bearings for the spindle d, on which will be slipped the tube or cone of paper or other material on which the yarn y taken from the spool d^4, having its journals in bearings d^5 erected on a part of the frame-work, will be wound. Secured to the holder by a set screw e' is a spring catch e, the free end of which bears on and acts frictionally against the rounded surface at the top of the stand c, the extent of the friction being regulated by a set screw e^2, and the greater the tension the harder the yarn will be wound on the cone or tube receiving the yarn. This spring catch also co-operates with a projection e^3, the catch engaging the projection to hold up the yoke after it has been lifted by the operator and during the time that the operator is removing the spindle for the reception of a new tube or cone. When the operator again desires to resume work she will pull down on the yoke and overcome the spring catch. The shank c^3 of the yoke is confined in the holder by a set screw e^4, such manner of connection permitting the yoke to be rotated more or less according to whether the yarn is to be wound on a conical or on a cylindrical tube.

I have provided the machine so far described with means to stop the rotation of the winding roll 24, whenever the yarn breaks. At each end of the drum a' I have located roll lifters f, shown as arms, connected to a lever g pivoted at g', said lever having a cam surface 2 adapted to be acted upon by a leg g^2

pivoted at g^3 on a bracket g^4 of the framework. The leg g^2 has pivoted upon it a leg lever h the outer end of which is normally elevated, as in Fig. 1. Each yarn g on its way to the spindle is passed through a suitable drop wire h', one end of which is connected to a rock shaft h^2. In case a yarn breaks, the drop wire will fall and acting on the leg lever h will turn it about its center of motion, lift its right hand or inner end and put it in the range of motion of the intermittingly rotating ratchet wheel m, on shaft m', so that said ratchet striking the end of the said lever will move it longitudinally and carry with it the leg g^2, and the latter acting on the cam surface of the lever g will turn it to elevate the lifting devices f and lift the roll 21 from contact with the drum, thus stopping the winding operation. Each drum has its own separate stop motion mechanism.

The lever g, the leg, the leg lever and ratchet wheel are common to my application, Serial No. 442,332, filed August 6, 1892, and the ratchet wheel and its shaft are common to my Patent No. 404,831, dated June 11, 1889.

This invention is not limited to the exact form of drop wire shown, and instead I may use any other equivalent form, and this is true as to the shape of the lever g and the devices to move it to actuate the roll lifting devices.

The bolt forming the pivot c' for the holder c^2 may by its nut c^x be made to clamp the holder and stand more or less closely together so as to require more or less strain to lift the free end of the yoke in the process of winding.

The lever g may be grasped at its outer end by the operator and be moved to lift the roll 21 whenever desired.

I do not claim a wedge to act upon and lift the winding roll from contact with the drum, and I am also aware that in machines for winding yarn, where a great number of yarns are put upon a spool, the winding drum and an intermediate roll have been made to rotate the spool receiving the numerous strands of yarn.

My invention does not relate to a winding machine but rather to a spooling machine.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a spooling machine, a rotating drum having a crossing groove a^2; a winding roll of much less diameter located directly above and normally resting upon the top of said drum to be rotated thereby many times during each rotation of the drum; a pivoted carrier; a spindle having its bearings in the free end thereto and adapted to receive a tube to be wound with yarn; and a traverse guide having a projection to enter the groove in said drum to reciprocate the traverse guide and cause it to lay the yarn from end to end of the tube on said spindle, combined with a lifting device, a drop wire, and intermediate devices to positively operate the lifting device on the breakage of the yarn, to thus effect the lifting of the rapidly running winding roll from the drum having the crossing groove, substantially as described.

2. In a spooling machine, a rotating drum; a winding roll of much less diameter located directly above and normally resting upon the top of said drum to be rotated thereby many times during each rotation of the drum; a yoke pivoted at a distance from the said drum; a spindle having its bearings in the said yoke and adapted to receive a tube to be wound with yarn, combined with a lifting device composed of a pivoted lever g having upright arms f extended across the ends of the drum and shaped to partially embrace the drum shaft a; and a drop wire, and intermediate devices, which, on the breaking of the yarn act to effect positively the movement of the lifting devices to lift the winding roll from contact with the drum, substantially as described.

3. In a spooling machine, a rotating drum having a crossing groove a^2, a winding roll of much less diameter located directly above and normally resting upon said drum and adapted to be rotated by it many times during each rotation of the drum: a thread-laying finger having a projection to enter said groove, the latter causing it to reciprocate the yarn longitudinally back and forth; a holder or carrier pivoted at one end at a distance from the axis of the drum and having one of its parts made to oscillate on the other part, the oscillating part having bearings for the spindle to receive a tube on which the yarn is to be wound, combined with a lifting device co-operating with the winding drum, a drop-wire, and devices actuated thereby and adapted to move the lifting device to lift the winding roll from the drum on the breakage of the yarn, substantially as described.

4. In a spooling machine the following instrumentalities, viz:—a rotating drum, a winding roll resting on and rotated by it; a yoke or carrier to sustain a tube or spindle to be filled with yarn; a lifting device to lift the winding roll from the surface of the drum; a leg lever, a pivoted support therefor, a drop wire to act upon said leg lever and turn the same upon the breaking of the thread, and an actuating device to strike said leg lever in its abnormal position, and during such operation turn the lifting device to effect the lifting of the winding roll from its driving drum and stop rotation of the [illegible] spindle being wound, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN W. FOSTER.

Witnesses:
A. E. DEAN,
FREDERICK L. EMERY.

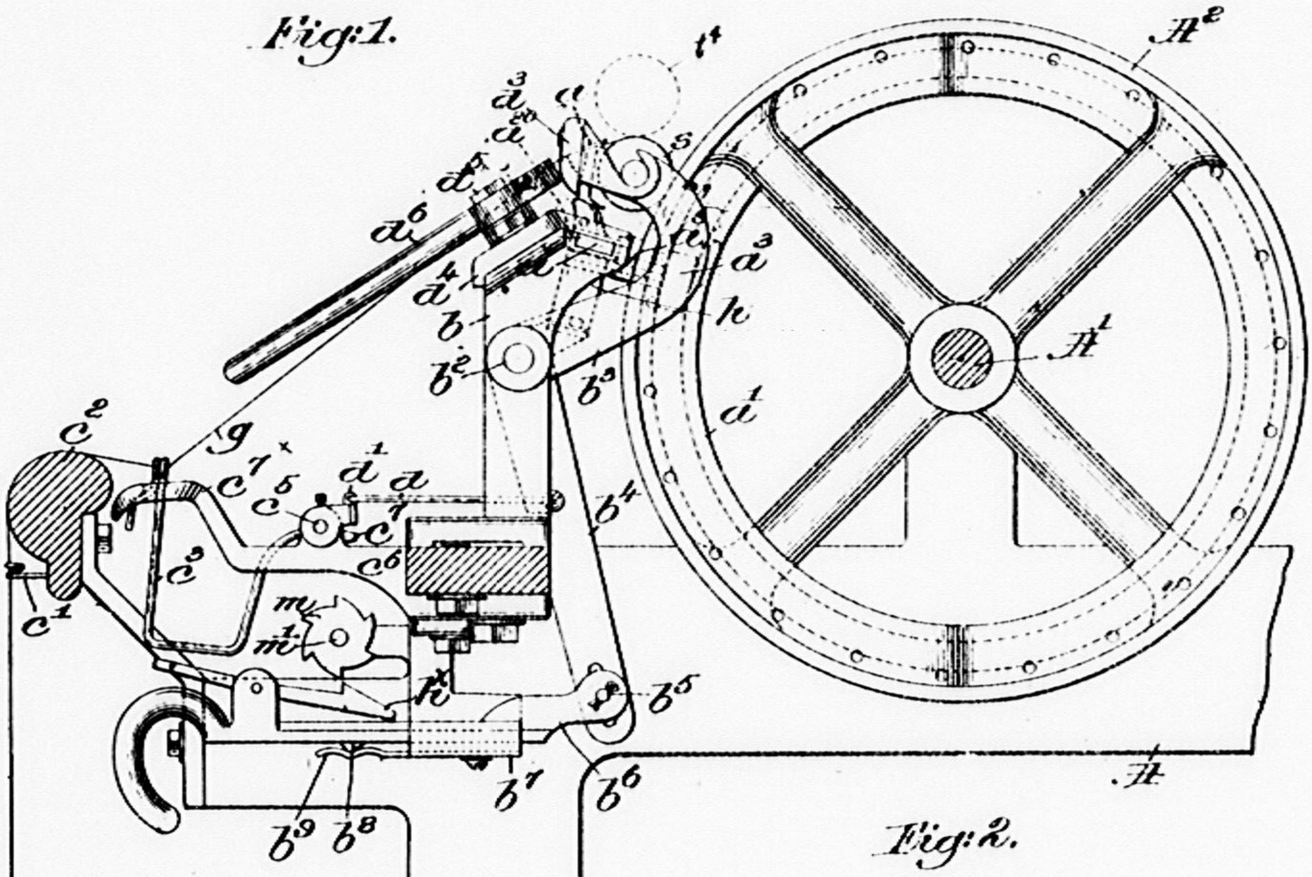
(No Model.) 2 Sheets—Sheet 1.

J. W. FOSTER.

SPOOLING MACHINE.

No. 585,198. Patented June 29, 1897.

Fig. 1.



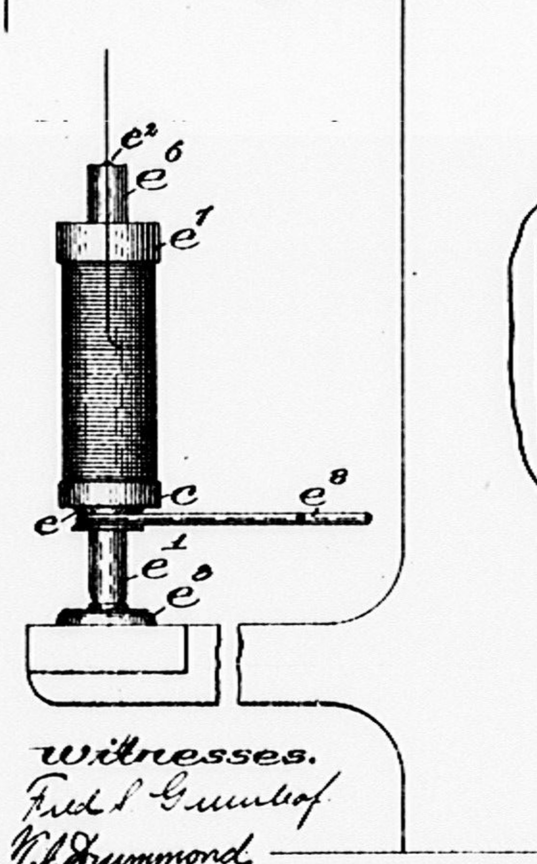


Fig. 2ª

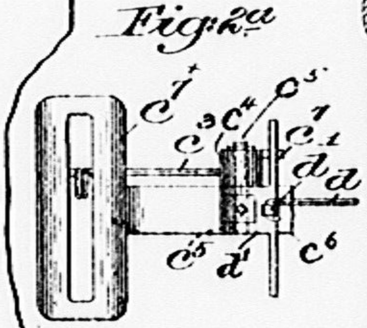


Fig. 2.

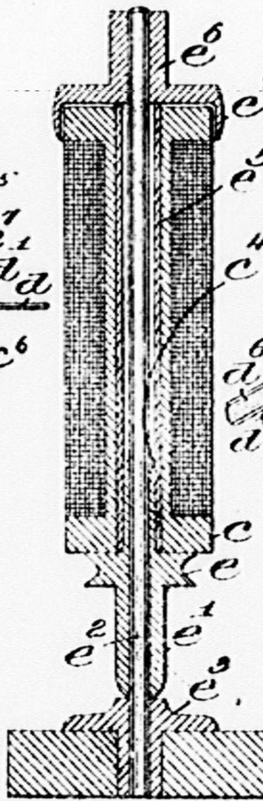
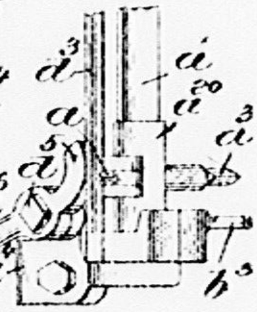


Fig. 2ᵇ



Witnesses.
Fred S. Grunleaf
W. J. Drummond.

Inventor.
John W. Foster
by Crosby Gregory
attys

(No Model.) 2 Sheets—Sheet 2.

J. W. FOSTER.

SPOOLING MACHINE.

No. 585,198. Patented June 29, 1897.

Fig: 3.

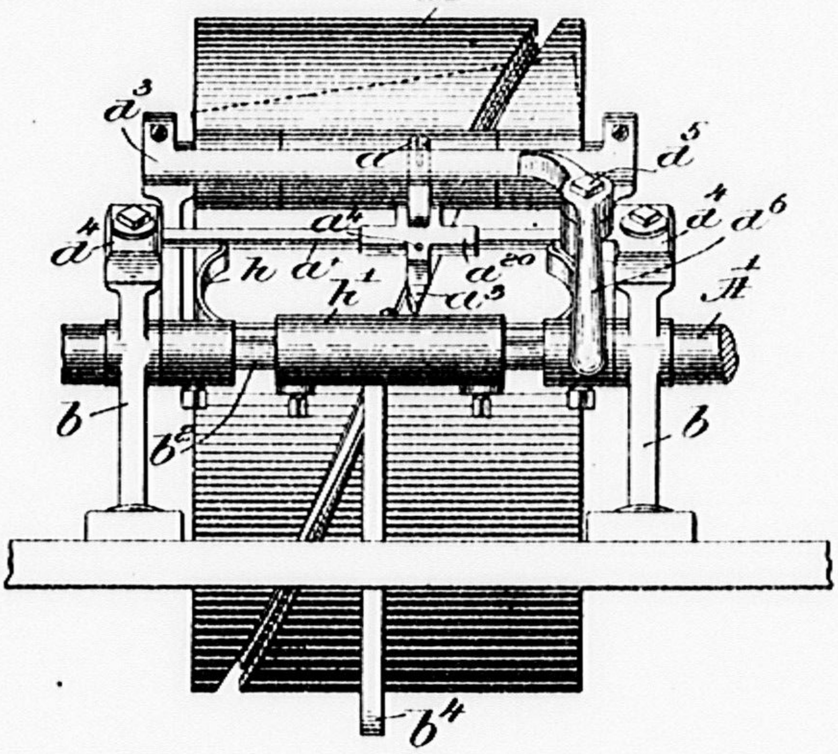


Fig: 5.

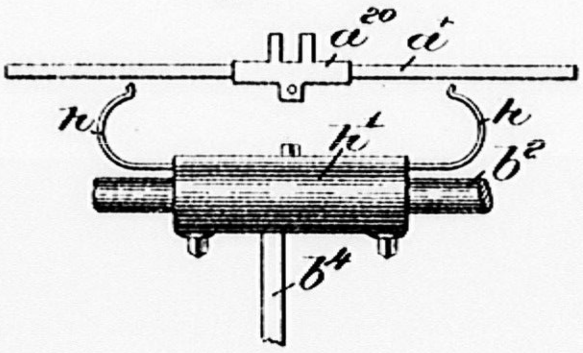
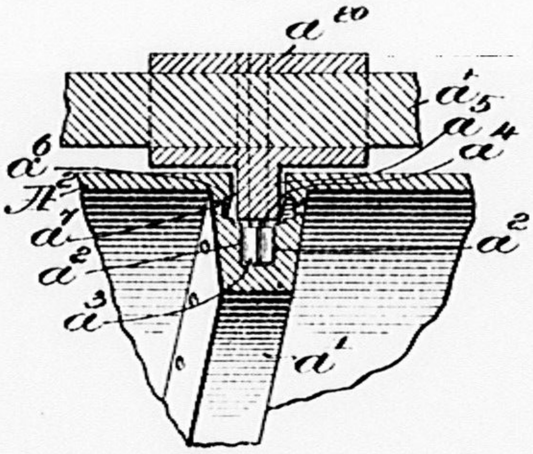


Fig: 4.



Witnesses.
Fred S. Greenleaf.
Edward F. Allen.

Inventor.
John W. Foster
by Crosby & Gregory, attys.

UNITED STATES PATENT OFFICE.

JOHN W. FOSTER, OF WESTFIELD, MASSACHUSETTS, ASSIGNOR TO THE FOSTER MACHINE COMPANY, OF SAME PLACE.

SPOOLING-MACHINE.

SPECIFICATION forming part of **Letters Patent No. 585,198**, dated June 29, 1897.

Application filed March 19, 1896. Serial No. 583,908. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. FOSTER, of Westfield, county of Hampden, State of Massachusetts, have invented an Improvement in Spooling-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to improve spooling-machines, whereby the yarn or thread of cotton, wool, or silk may be wound more rapidly.

The machine is provided with a drop wire or lever to actuate a leg-lever or other device of a stop-motion mechanism when a yarn or thread breaks or becomes too slack, and I have combined with this drop wire or lever devices to automatically lift it in position to be rethreaded. I have also provided novel means for insuring the delivery of the yarn or thread from the end of the spool supplying the same to be wound on a conical or other shaped tube or holder, and the spindle carrying said spool may be rotated very slowly, if desired, to prevent any loss of twist in unwinding the yarn or thread from the end of the spool.

Figure 1, in side or end elevation, shows a sufficient portion of a spooling-machine to enable my invention to be understood, the support for the spindle carrying the spool being broken out and the spindle being shown as moved inwardly toward the center of the machine out of its true working position, with its end under the usual guide-eye, to thus save space on the drawings, the cone on which the thread is to be wound being omitted. Fig. 2 is an enlarged section of the spindle, spool, and spindle-cap; Figs. 2^a and 2^b, details to be described; Fig. 3, a detail showing the face of the drum, a cone-holder and cone, and the yarn or thread guide and its support, the guide being actuated by the groove of the drum, the winding-roll and its carrying-arms being omitted. Fig. 4 is an enlarged detail showing part of the drum with its peculiar-shaped groove and traveler of the yarn or thread guide arranged therein; and Fig. 5 shows, detached from Fig. 1, the yarn or thread guide and the reversing-spring.

The frame A, of suitable shape to contain the working parts, has a shaft A', on which is mounted a drum A^2 or a series of drums having each a groove running diagonally about it for the reception of a traveler from a thread-guide to be described, the said drum or drums being of such size as to wind a conical or straight cop-tube at each side thereof, as in United States Patent No. 535,616, granted to me, and dated March 12, 1895.

Fig. 3 shows a yoke or carrier *w*, such as may be used to hold a conical shell *r*, on which the yarn or thread may be wound.

I will first describe my improvements in the drum.

It is an object in this class of machines to make the drum as light and thin as possible, and heretofore the periphery of the drum has been of uniform thickness and has been provided with a shallow groove extended about the drum, in which entered a shallow traveler connected to the thread-guide. These machines are run at a high speed, for it is a great desideratum to spool the greatest number of yards of yarn or thread possible in a given time. I have found in practice that the practical speed of the drum is limited to the strength of the traveler and the rapidity with which the thread-guide may be reciprocated without breaking. The larger the diameter of the drum the greater its surface speed and the faster it will rotate a cop and the more yarn or thread it will wind on a cop-tube at each rotation.

Heretofore the practical diameter of the drum has been found to be twelve inches, and the thread-guide will run practically in a groove in the surface of such a drum. I have found it practicable to use a drum of thirteen and three-eighths inches diameter.

It will be remembered that the surface of the drum travels at the fastest speed and that as one approaches the center of motion thereof the speed of movement of the parts of the drum decreases.

To enable me to actuate the thread-guide *a* to be reciprocated at the usual practical speed which is effected by a twelve-inch drum and yet increase the speed of rotation of the cop to a speed which would be derived from the surface velocity of, say, a drum for thirteen and three-eighths inches in diameter, I have provided the inner side of the periphery of the drum with a rib a' and, as best shown in Fig. 5, I have cut a groove through said drum and into the rib, leaving in the rib side walls located at a distance, say, of substantially one and three-eighths inches from the periphery of the drum, and into this groove I have placed the traveler a^3, its carrying-pin a^4 being extended into a hub a^5 of the thread-guide carrier a^{20}, which hub enters a wider part of the groove in the periphery of the drum, the hub preferably not touching the walls of the groove in said periphery. In this way the slower moving part of the drum—viz., the side walls of the groove in the rib—acts frictionally against the traveler a^3, and said side walls, traveling at a slower speed than the side walls of the groove in the periphery of the drum, act in greatly reducing the friction and wear on the traveler.

In the old form of drum the traveler could not be oiled, because the oil escaped to the outside of the drum and was taken up on the winding-roll s, lying against the drum, and was by it put onto the yarn or thread, soiling it.

To enable the traveler employed by me to be oiled and thus greatly reduce its friction when being moved, I have provided each inner side wall of the groove in the rib with a like oil pocket or groove a^6, having its mouth a little wider than its bottom, and I have provided the bottom of each of said grooves with suitable eduction-holes a^7, said holes being outwardly inclined, as shown best in Fig. 4, so that oil put into the groove in which the traveler runs will by centrifugal action be forced into the pockets, and if too much oil will issue through the holes a^7 onto the interior of the drum, where it will do no harm and can be wiped off from time to time.

The thread-guide carrier a^{20} runs on a bar $a^{\times}$, held in suitable supports b, and lest the blow of the groove in reversing the thread-guide should be too hard I have combined with the bar and guide a suitable spring h, (see Figs. 1 and 6,) against which the ends of the guide strike at the ends of its stroke, the said spring taking the shock of the stroke of the guide, thus relieving the traveler and its pin and starting the thread-guide, so that it will quickly commence its return stroke with the minimum of strain on the traveler, so that the latter is not worn and the pin not strained and will run for a very long time.

The arms b support a rock-shaft b^2, having upwardly-extended arms b^3, which have open forks to receive the winding-roll s, which acts just as in the patent referred to, said shaft having a depending arm b^4, to which is jointed at b^5 a bar b^6, fitted into a guide-box b^7, the bar having at its under side a suitable projection b^8, with which coöperates a spring b^9, having, preferably, two holding-recesses, in one or the other of which said projection will rest. This bar has pivoted on it a lever $h^{\times}$, the inner or heavier end of which is normally down, as in Fig. 1, the said lever having a hook which is acted on when raised by one of the teeth of a ratchet m, fast on a rotating shaft m' common to said patent, but designated by different letters.

The yarn or thread y is led from a spool c, to be described, through a guide-eye c', over a beam c^2, thence through an eye in the drop-lever c^3, connected to a collar c^4, loose on a stud c^5, held in an ear rising from the arm c^6, said collar having a toe c^7.

The yarn or thread is led from the drop-lever to the thread-guide a, and the lever is held by the thread with its eye above the top of the drop-lever guide $c^{7\times}$; but when the yarn or thread breaks the drop-lever descends and strikes the front end of the lever $h^{\times}$, causing its other end to be engaged by the stop-wheel m, such engagement of the lever causing the bar b^6 to be slid to the right in Fig. 1, turning the rock-shaft b^2 in the direction to remove the winding-roll from the drum. I utilize this movement of the rock-shaft to reset the drop-lever, for I have connected to the arm b^4 of the rock-shaft a rod d, attached at its other end to a lifting device d'. (Shown in Fig. 2ª as a yoke having ears to span the ear of the arm c^6, the ears having holes to receive the pin c^5.)

As the rod d is drawn to the right the under side of the lifting device acts on the toe c^7 and turns the collar in the direction to lift the eye end of the drop-lever above the guide $c^{7\times}$, leaving it in position to be rethreaded and obviating the necessity of the operator engaging the drop-lever to lift it by hand.

I have connected the upper ends of the arms b^3 by a bar d^3, and on one of the caps d^4, used to hold the bar $a^{\times}$ in Fig. 1, I have placed a stud d^5, on which I have mounted a starting-lever d^6, the upper short cam-shaped end of said lever (see Fig. 2^b) being adapted when the lever is moved by the operator in the direction of the arrow in Fig. 2^b to act on the bar d^3 and turn the rock-shaft b^2 in the direction to cause the winding-roll to again contact with the drum and be rotated to recommence the winding.

The spool c rests on a grooved collar e of a whirl e', surrounding loosely a dead-spindle e^2, the end of the whirl being reduced in diameter and resting on a step e^3.

The whirl has above its grooved collar e an extension e^4, which has fixed to it a tubular sleeve e^5, extended up through and above the top of the spool, where the upper end of the tube (see Fig. 2) receives upon it and supports clear of the spool a metal cap e^6, having a circular flange e^7 to overlap and inclose the head of the spool. The spool fits the tube loosely, and the yarn or thread is led up or off from the end of the spool, it during its delivery running or traveling about the edge of the cap.

I may, if desired, provide the groove of the collar e with a band e^8, driving the same slowly from any suitable moving shaft of the machine (not shown) as spindle-driving bands are now driven, said band rotating the spool slowly to thus obviate taking out any of the twist in the yarn.

The spring h (see Fig. 5) is connected to a block h', fast on the rock-shaft b^2, but this invention is not limited to the exact shape shown for the said spring, and the shape may be varied without departing from my invention.

The thread-guide a is pivoted on the carrier a^{20} and is slotted at its upper end and is of such length that when the winding-roll s is thrown away from the drum to stop winding the said roll will act against the pivoted thread-guide and turn it outwardly far enough to cause it to release the thread and leave it lying on the top of the bar and roll, so that as the traveler continues to slide back and forth the thread-guide does not move the thread with it. The dotted lines t^4 above the roll s show the position of the tube or holder and the yarn being wound on it.

The spool surrounds the tube e^5 loosely, so that the spool may turn freely on the tube on the occurrence of any strain on the yarn.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a spooling-machine, a shell-like drum having an internal diagonal rib, provided with a diagonal groove in prolongation of a diagonal groove extended entirely through the thickness of said drum, the side walls of the groove in said rib presenting traveler-actuating surfaces wholly within the thickness of the body of said shell, combined with a thread-guide support, a thread-guide, and its connected traveler, the latter being actuated by the side walls of the groove in said rib, substantially as described.

2. In a spooling-machine, a drum having an internal diagonal rib provided with a groove for the reception of a traveler connected to the thread-guide, the inner walls of said groove having oil-receiving pockets, said pockets having eduction-holes for the oil, combined with a thread-guide and its traveler actuated by the walls of the groove in said rib, substantially as described.

3. In a spooling-machine, a drum having at its interior a diagonal rib, the said drum and rib being each grooved, the groove in the rib being enlarged near the inner side of the drum to provide pockets, a bar, a thread-guide free to be moved thereon and a traveler connected to the thread-guide, the traveler entering the groove in the rib inside the periphery of the drum, substantially as described.

4. In a spooling-machine, a drum having at its interior a diagonal rib, the said drum and rib being provided with grooves, a bar, a thread-guide free to be moved thereon and provided with a traveler, the traveler entering the groove in the rib inside the periphery of the drum, combined with a spring to arrest the thread-guide at the end of its stroke and reduce the strain on the traveler connected to the thread-guide, substantially as described.

5. In a spooling-machine, a drop-lever having an eye to hang on the thread, a guide in which it plays, and a stop mechanism actuated by the dropping of the drop-lever, and means connected with said drop-lever to cause it when released to automatically lift the drop-wire into position again where it may be rethreaded, substantially as described.

6. The drum, the winding-roll actuated by it, a rock-shaft having arms to carry said roll, an arm b^4 attached to said rock-shaft, and a collar and its attached drop-lever combined with means between said arm and collar to lift the drop-lever as the said arm is moved in the direction to remove the winding-roll from contact with the drum, substantially as described.

7. The drum, the winding-roll adapted to be rotated by said drum, a rock-shaft having arms provided with bearings for the journals of said roll, a connecting-bar d^3 uniting said arms, and a stand, combined with a lever pivoted on said stand and provided with a cam-shaped end to act on the said connecting-bar when the said lever is turned in one direction to put the winding-roll in contact with the said drum, substantially as described.

8. In a spooling-machine, a spindle, a sleeve-whirl having a collar grooved externally for the reception of a band and surrounding said spindle loosely, a tube attached to said sleeve-whirl, a step to support one end of said sleeve-whirl, a cap applied loosely to the upper end of said spindle and supported wholly by the end of said tube leaving a space between said collar and the upper end of said tube for the reception of a spool, and a band to rotate said sleeve-whirl slowly, combined with a drum, a thread-guide reciprocated thereby, and a winding-roll to receive the thread from the spool on said spindle, the thread from said spool on said spindle passing over the edge of the cap, the rotation of the said sleeve-whirl during the delivery of the thread from it keeping the twist uniform, substantially as described.

9. In a spooling-machine, a drum having at its inner side a diagonal rib, the said drum and rib being grooved to leave side walls to act against a traveler at a point within the inner side of the periphery of the drum, combined with a winding-roll to rest against the face of the drum, a bar, and a thread-guide thereon having an attached traveler extended through the slot of the drum and into the slot in the rib inside the drum, whereby the winding-roll is actuated by the fastest moving part of the drum and the traveler by a much slower moving part of the drum, substantially as and for the purpose described.

10. In a spooling-machine, a winding-drum having an internal diagonal rib grooved for the reception of a traveler, and having side walls located in said groove within the

periphery of said drum, combined with a thread-guide having an attached traveler which is acted upon by the side walls of the groove in the said rib, whereby the traveler is actuated by a surface moving more slowly than the periphery of said drum, substantially as described.

11. In a spooling-machine, a drum, a winding-roll actuated thereby, and a reciprocating thread-guide carrier having a pivoted thread-guide mounted thereon, combined with a bar toward which the thread-guide is turned by the winding-roll as the latter is moved away from the drum to automatically stop the winding operation, the said bar receiving upon it the thread from the thread-guide as the latter is turned back and removed from the thread, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN W. FOSTER.

Witnesses:
GEO. W. GREGORY,
MARGARET A. DUNN.

No. 655,616. Patented Aug. 7, 1900.

C. F. FOSTER.

SPOOLING MACHINE.

(Application filed Jan. 27, 1900.)

(No Model.) 2 Sheets—Sheet 1.

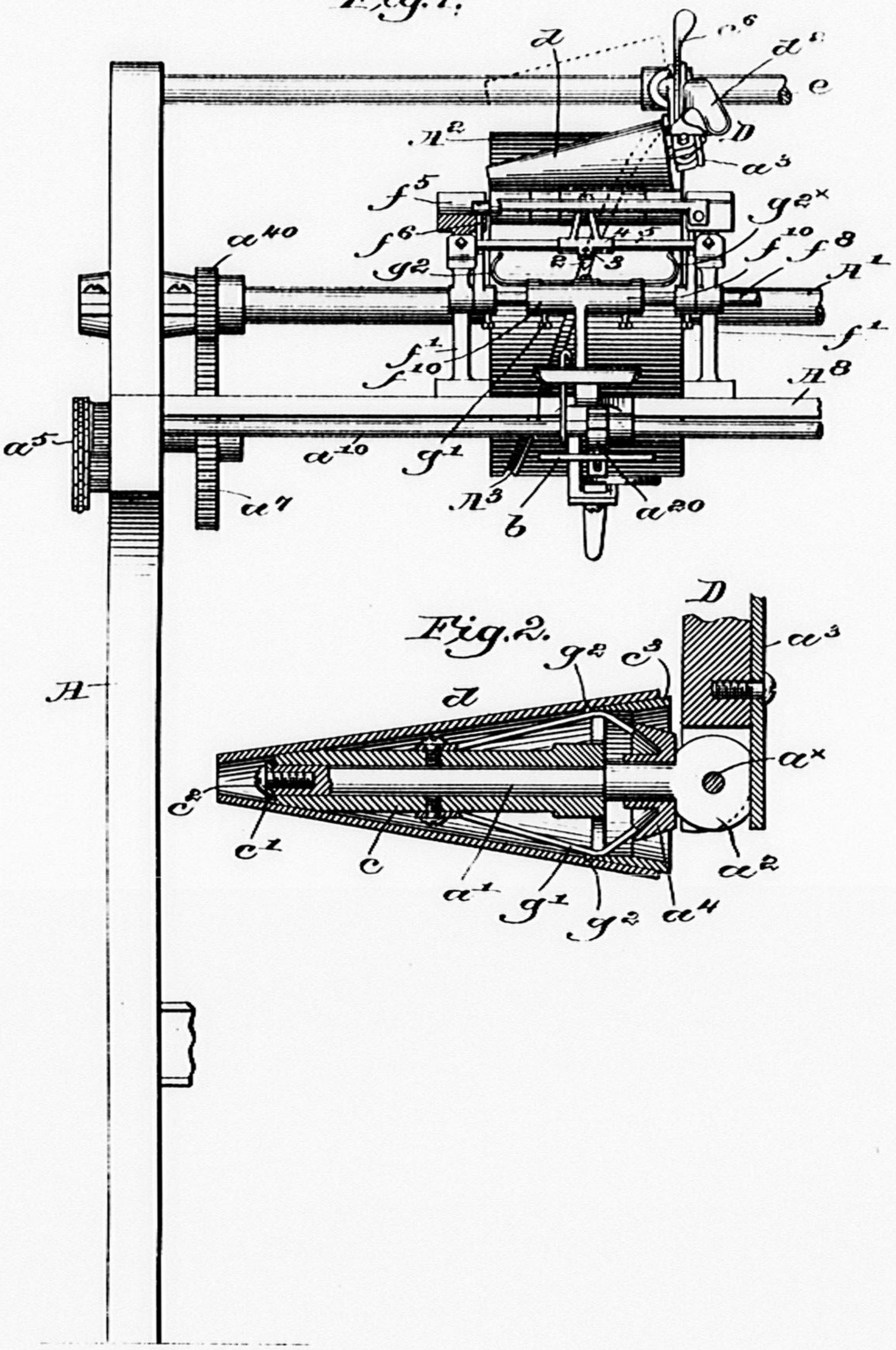


Fig. 1.

Fig. 2.

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No. 655,616.

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(Application filed Jan. 27, 1900.)

(No Model.

2 Sheets—Sheet 2.

Fig. 3.

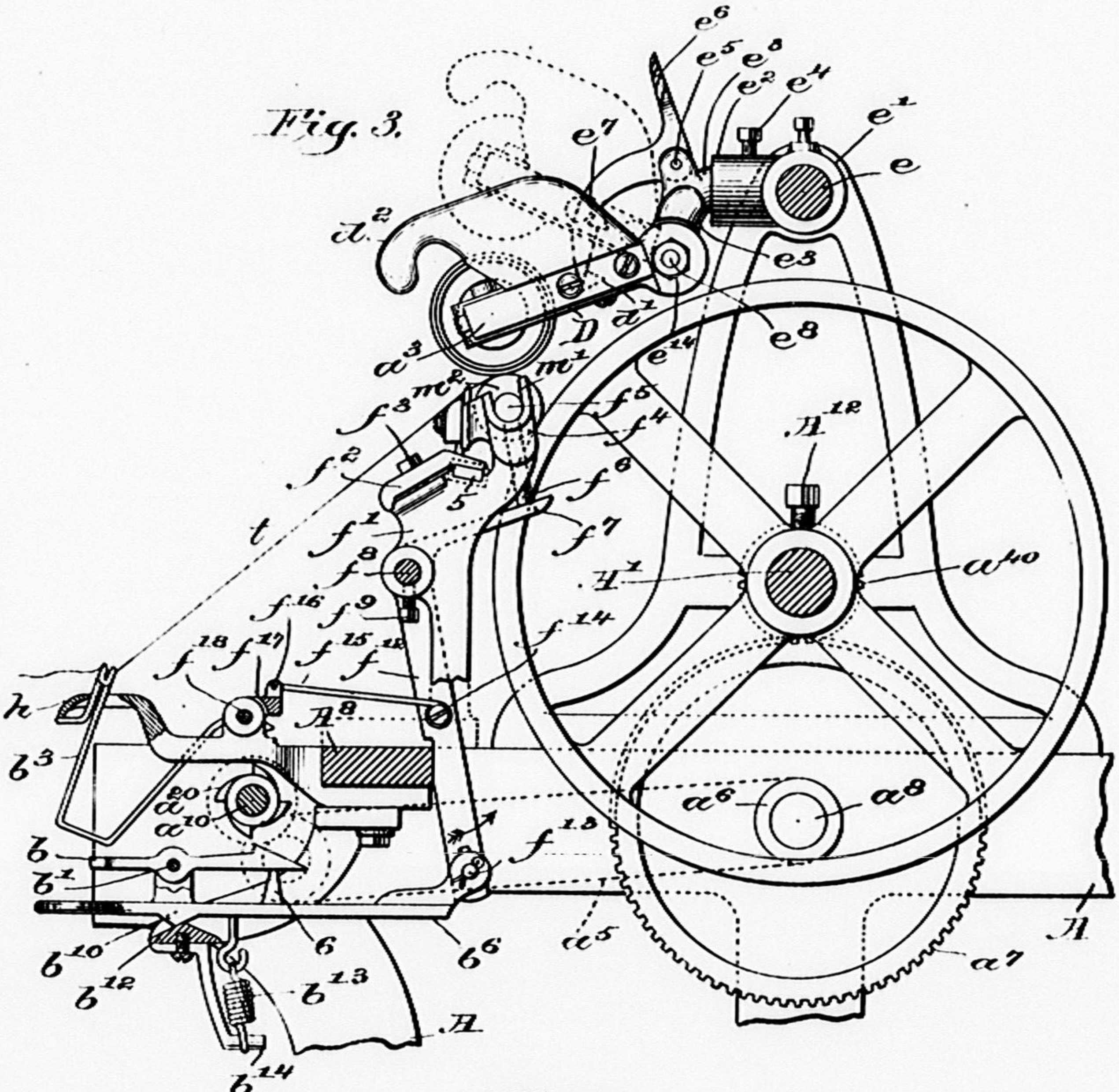


Fig.4.

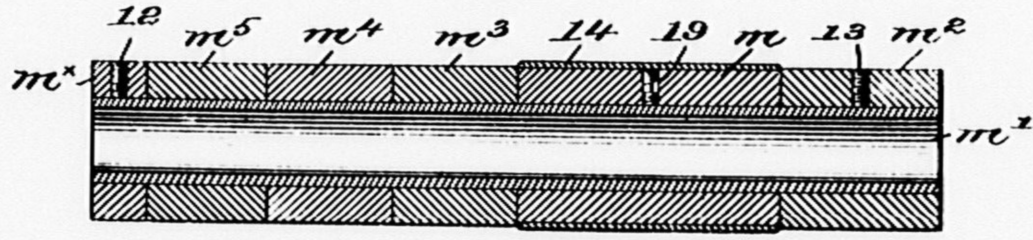
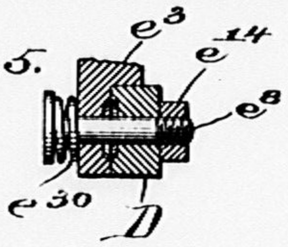


Fig.5.



Witnesses.
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UNITED STATES PATENT OFFICE.

CHARLES F. FOSTER, OF WESTFIELD, MASSACHUSETTS, ASSIGNOR TO THE FOSTER MACHINE COMPANY, OF SAME PLACE.

SPOOLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 655,616, dated August 7, 1900.

Application filed January 27, 1900. Serial No. 2,931. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. FOSTER, a citizen of the United States, residing at Westfield, in the county of Hampden and State of Massachusetts, have invented an Improvement in Spooling-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention has for its object to improve the construction of spooling-machines, such as represented in United States Patent No. 535,616, dated March 12, 1895, wherein a device carrying a cone-shaped or a tubular shell on which the thread or yarn is wound is rotated by contact with a winding-roller driven by a drum.

My present invention includes a novel construction of winding-roll and novel mechanism for stopping the rotation of the winding-roll to stop the rotation of the shell receiving the thread or yarn and also a novel construction of means for supporting the arm carrying the winding-spindle, whereby the thread or yarn after the same has been wound upon the shell will not be cut or broken by the action of the thread-guide against the wound mass of thread or yarn.

Figure 1 of the drawings represents a partial front side elevation of the spooling-machine containing my present improvements. Fig. 2 shows part of a carrier and its spindle, the latter carrying a conical shell. Fig. 3 is an enlarged view of the parts represented in Fig. 1 looking at it from the right. Fig. 4 is an enlarged longitudinal section of the winding-roller; and Fig. 5 is a detail showing the arm D and its supporting-stand in section and its pivot e^8 in elevation, said detail showing the tension device for said arm.

Referring to the drawings, A represents one end of the framework of a machine, A' the main shaft thereof, and A^2 one of a series of drums having a spiral groove A^3 to receive a pivoted shoe 2, (see Fig. 1,) connected loosely through a suitable stud 3 with a thread-guide 4, guided by a suitable bar, as 5. The shaft a^{10} derives its movement from a sprocket-chain a^5, Fig. 3, fast on the hub of a toothed gear a^7, loose on a stud a^8, supported by the frame, said gear being driven by a pinion a^{40} on the shaft A', said shaft a^{10} having a stop-motion-moving ratchet-wheel a^{20}, adapted to engage the toothed end of a lever b, pivoted at b' and maintained normally in the position shown in Fig. 3 by contact with a suitable projection 6, connected with a slide-bar b^6, said ratchet being adapted to be turned about its pivot to put its hooked end in the path of movement of said ratchet-wheel whenever a drop device, as b^3, normally hanging on the thread, drops by reason of breakage of the thread to effect the stopping of the machine, and the cross-rod e, mounted in uprights erected upon the frame sides, are and may be substantially as represented in said United States patent, it being understood that in practice the machine to be herein described will have contacting with the drum at two or more points suitable driving-rollers to actuate a plurality of series of spindles carrying shells upon which the thread or yarn is to be wound, as provided for in said patent.

The arm D, provided with the spring a^3, the spindle a', having a head a^2 pivoted at $a^\times$ on a part of said arm, and the conical block a^4, loose on said spindle and having at one side thereof a recess which is adapted to receive in it the free ends of shell-holding springs g', which may be provided with points, as g^2, to enter the paper or other tube d, are and may be all substantially as fully described in United States Patent No. 535,617, dated March 12, 1895, with the exception that the shape of the arm D and the point where it is pivoted are herein differently constructed.

The spindle a' receives about it, as provided for in the latter patent, a carrier or tube c, with which the springs g' are suitably connected, and this carrier or tube, rotatable freely on or with relation to the spindle, has a head c^3, which is of a shape and diameter to properly fill one end of the shell, either a cone or a cylinder, the opposite end of the carrier or tube meeting and supporting the shell at its outer or small end, the carrier or tube being kept upon the spindle by means of a suitable set-screw, as c^2, working against a washer, as c'.

Having briefly referred to parts which are old and common, I will now describe the particular features in which my present invention consists.

In the Patent No. 535,616 referred to the rod e, located in a substantially-vertical line above the main shaft A' and parallel therewith, served as a fulcrum for the arm D, carrying the spindle a' referred to, and as the yarn mass was increased in diameter the swinging of the arm from the center described therein caused such a movement of the yarn mass that it came into the line of travel of the thread-guide, which by striking against the yarn mass resulted in cutting the thread or yarn already wound into the yarn mass, thus destroying the value thereof. To overcome the possibility of the yarn mass being struck by the reciprocating thread-guide, I have changed the pivotal point of the arm D by providing the rod e with a series of collars e', having projections e^2, which receive in an adjustable manner the shanks of suitable stands e^3, said stands being held adjustably in said projections by means of suitable set-screws e^4, the shanks being rounded, so that they may be rotated more or less in the sleeves in order to secure for each spindle a' the proper horizontal alinement. These shanks receive a stud e^5, upon which I have mounted a suitable latch or yarn-holder e^6, it having at its lower end a suitable hook, as e^7, (represented by dotted lines in Fig. 3,) and said stand also receives in a depending branch thereof a stud e^8, constituting the fulcrum for the arm, whereby said fulcrum is brought quite close to the surface of the drum a^2 and quite close to the path in which reciprocates the thread-guide 4, the arm D so mounted moving up and down in the arc of a circle described from the pivot e^8, which is so located that the yarn or thread mass will not come into the path of movement of and be struck by the reciprocating thread-guide, and consequently the wound thread or yarn is not injured or broken during the winding operation.

The pivot e^8, supporting the arm D, is located at one side of a vertical line intersecting the shaft carrying the drum, such location of said pivot enabling the arm during the thread-winding operation to swing, due to increase of thickness of the thread or yarn mass thereon, it moving in such an arc of a circle that the thread mass cannot after it is wound contact with the reciprocating thread-guide.

The arm D has projecting inwardly from it (see dotted lines, Fig. 3) a suitable projection d', and said arm has an attached weight d^2, made as a handpiece, which when the winding is to be stopped or when a shell d is to be applied to receive thread or yarn or a wound shell is to be removed will be lifted, as herein represented, by hand and put into the dotted-line position, Fig. 3, in which position the hook e^7 of the latch will engage said projection and maintain the arm and spindle in their inoperative position.

Herein I have represented the latch e^6 as normally occupying a position due to gravity to automatically engage the projection d' whenever the arm D is lifted, and to release the arm it is only necessary for the operator to take hold of the upper end of the latch and turn it backwardly or to the right, viewing Fig. 3, and thereafter the arm D may be brought into position to have the thread wound upon the cone or tube carried thereby.

The driving-rolls herein represented are of novel construction (see Fig. 4)—as, for instance, the driving-roll is composed of several independently-movable sections, the section m being herein represented as of the greatest length, being secured by a set-screw 10 to a suitable sleeve m', the sleeve having, as herein shown, fixed to it outside one end of the section m by a screw 13 a roller m^2, the sleeve at the opposite side of the section m having applied to it loosely three rollers m^3, m^4, and m^5, the latter rollers being held on the sleeve by a collar $m^\times$, through which is extended a set-screw 12. The section m has a leather cover 14. The sleeve m', with its parts constituting a winding-roller, is applied loosely to a journal f^5, supported as will be hereinafter described.

For the best results the arm D should be held when in its operative position by sufficient friction, so that it will be moved only positively by the increasing diameter of the yarn mass, and to provide for this friction or tension I may place between the head of the bolt e^8 and the stand e^3, through which the bolt is inserted preparatory to entering a hole in the inner end of the arm D, any usual spring or tension device e^{30}, so that by adjusting the nut e^{11} the effective strength or tension of this spring may be varied according to the yarn being wound.

The slide b^6, before described, has at its lower side a suitable two-faced cam b^{10}, which rests upon a two-faced cam b^{12}, the said cams being kept in operative contact by or through a suitable spring b^{13}, suitably connected at one end with said slide and at its opposite end with a projection, as b^{14}, from the cam-shaped bar b^{12}. The front end of the slide b^6 is loop-shaped and is represented as adapted to be engaged by the operator whenever for any reason he desires to stop the winding operation; but this bar may be slid also automatically to stop the winding operation whenever the thread or yarn t, coming from any suitable source and being wound upon the shell d, which may be a cone or a cylindrical tube, is broken, this being done by the ratchet-wheel a^{20}, before described, engaging the hook of the lever b.

I have mounted upon a suitable cross-bar A^8, it in practice connecting the opposite ends of the frame of the machine, suitable uprights f', the upper ends of said uprights being suitably shaped (see Fig. 3) to receive the bar 5, upon which slides the thread-guide 4, said bar having its under side and edges seated and held seated in suitable notches of the stand by a clamp, as f^2, held in position by a suitable set-screw, as f^3, acting upon the upper side of said bar to confine it fixedly in position to receive and guide the thread-guide 4, the latter being made as light as possible to thereby overcome the strains due to momentum, as when changing the direction of movement of the thread-guide rapidly. To provide for this lightness in weight of the thread-guide, I have made the same in skeleton form, and the bar 5 is set angularly, as represented in Fig. 3, so that the pin 3, carrying the shoe 2, may extend inwardly directly from the inner side of the foot of the thread-guide and enter the groove in the drum.

Each drum A^2, usually a number of them, mounted upon the shaft A' at suitable distances apart, is held in position on said shaft by means of a suitable set-screw A^{12}.

The uprights f' have open bearings f^4 to receive the journal f^5 for the winding-roller, said bearings having suitable holes to receive journal-elevators, represented as dowel-pins f^6, the lower end of said dowel-pins resting loosely upon inwardly-extended arms f^7, connected with a rock-shaft f^8 by suitable set-screws f^9, there being two such arms for each journal. The rock-shaft f^8 is surrounded between the uprights f' by a sleeve f^{10}, fixed thereto by set-screws g', said sleeve f^{10} having a suitable arm f^{12}, to the lower end of which is jointed by a pin f^{13} the inner end of the slide b^6, and, as herein represented, said arm f^{12} has connected with it at f^{14} a rod f^{15}, in turn jointed at f^{16} to a suitable block f^{17}, pivoted at f^{18}, said pivot carrying the drop-wire, so that whenever the rod b^6 is moved inwardly or to the right, viewing Fig. 3, preparatory to stopping the machine the arm f^{12} will be moved in such direction as to cause the rod f^{15} to lift the drop-wire b^3, putting it into the position Fig. 3, all ready to be again handily threaded preparatory to starting the machine again into operation. Whenever the lever f^{12} is turned in the direction of the arrow on it in Fig. 3, whether by the hand of the operator or by a broken thread, the arms f^7 will be raised and acting upon the journal-elevators or dowel-pins f^6 will lift the journal, removing the driving-rolls immediately from frictional contact with the drum, so that the driving-roll will be left at rest, the drum continuing its rotation and the thread-guide continuing its rotation.

The hub f^{10} has connected with it in any suitable manner suitable spring-pieces, as $g^{2\times}$, against which may contact the ends of the thread-guide 4 as the latter reaches the end of its winding stroke, said springs aiding in overcoming the momentum of the thread-guide and by their reaction aiding in changing the direction of movement of the thread-guide.

The cross-bar A^8 has suitably connected with it thread or yarn supports h, represented as slotted to receive and guide the drop devices, said supports also sustaining the fulcrum f^{18} for the drop devices.

I have herein shown dowel-pins as the journal-lifters, they being the simplest form of lifting device known to me; but it will be obvious that any movable device occupying a position in or near the bearings supporting the journal f^5 and adapted to act on the lower side of the same to slide the said journal in a direction to remove the roller from contact with the drum may be employed and yet be within the scope of my invention.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a spooling-machine, a drum, a winding-roll adapted to be rotated thereby and mounted loosely upon a suitable journal, and means coöperating with said journal to lift it and remove the roll from frictional contact with said drum.

2. In a spooling-machine, a winding-roll composed of a roller having a fixed sleeve extended therefrom, a plurality of rollers loose on said sleeve.

3. In a spooling-machine, a winding-roll composed of a roller having a fixed sleeve extended therefrom, a plurality of rollers loose on said sleeve, and a journal to sustain said sleeve loosely.

4. In a spooling-machine, a drum, means to rotate it, a winding-roll having a journal, bearings to sustain said journal, journal-lifting means extended through said bearings, and means to slide said journal-lifting means to remove the winding-roll from contact with said drum.

5. In a spooling-machine, a journal supporting a winding-roll, a stand having bearings for the journal of said winding-roll, dowel-pins guided in said bearings, a stop-motion device adapted to be operated by the breakage of the thread or yarn being wound, and means controlled by said stop-motion device to move said dowel-pins in said bearings to meet and lift the journal of said roll from its bearings.

6. In a spooling-machine, a winding-roll, suitable bearings for the journal of said roll, a rock-shaft having arms, means actuated by said arms and adapted to act upon the journal of said winding-rolls to lift the same from its bearings, means to operate said rock-shaft.

7. In a spooling-machine, a shaft, a drum carried thereby, a reciprocating thread-guide, a winding-roll adapted to be rotated by said drum, an arm carrying a spindle, a pivot for said arm parallel with the longitudinal axis of said drum, said pivot being located substantially close to said drum and at one side a vertical line intersecting the longitudinal axis of the drum and the axis of said winding-roll, the described location of the pivot of said arm preventing the contact of the enlarging thread mass with the reciprocating thread-guide.

8. In a spooling-machine, a drum, a rod parallel with the axis of rotation of said drum, a stand rotatably and slidably mounted upon or with relation to said rod and having a depending ear, an arm carrying a spindle and pivoted upon said depending ear whereby said pivot is located substantially close to the surface of the drum and at one side of a vertical line intersecting the axis of rotation of said drum.

9. In a spooling-machine, a drum, a rod parallel with the axis of rotation of said drum, a sleeve adjustably mounted on said rod, a stand having its shank adjustable and rotatable in said sleeve, said stand having a depending ear and a pivot, combined with an arm mounted to turn on said pivot and carrying a spindle provided with a tube for the reception of a shell on which the thread or yarn is to be wound.

10. In a spooling-machine, a drum, a rod parallel with the axis of rotation of said drum, a sleeve adjustably mounted on said rod, a stand having its shank adjustable and rotatable in said sleeve, said stand having a depending ear and a pivot, an arm surrounding said pivot, and a tension device coöperating with said pivot to produce friction upon said arm that it may be moved only positively during the winding operation due to increase in diameter of the thread mass being wound.

11. In a spooling-machine, a drum, a shaft carrying said drum, a rod occupying a position parallel with the axis of rotation of said drum, stands adjustably connected with said rod and having a depending ear, an arm pivotally mounted on the ear of said stand and carrying a spindle, and a locking device to engage a suitable projection of said arm when the latter is put in its inoperative position, said locking device retaining said arm in such position for the removal of thread or yarn from the spindle or the application of a new shell to the spindle.

12. In a spooling-machine, the following instrumentalities, viz: a drum having a spiral groove, a rod parallel with the axis of motion of said drum, a winding-roller, means to sustain the journal of said roller, dowel-pins acting upon said journal, means to move said dowel-pins to act upon said journal and remove the driving-roll from contact with said drum, an arm having a spindle, said arm being pivoted upon a depending ear of a stand adjustably mounted upon or with relation to said rod, and means to resist frictionally the movement of said arm due to increase of diameter of the thread mass being wound about a shell carried by a spindle mounted in said arm.

13. In a spooling-machine, the following instrumentalities, viz: a drum having a spiral groove, a rod parallel with the axis of motion of said drum, a winding-roller, means to sustain the journal of said roller, dowel-pins acting upon said journal, means to move said dowel-pins to act upon said journal and remove the driving-roll from contact with said drum, an arm having a spindle, said arm being pivoted upon a depending ear of a stand adjustably mounted upon or with relation to said rod, and means to resist frictionally the movement of said arm due to increase of diameter of the thread mass being wound about a shell carried by a spindle mounted in said arm, and a suitable locking device connected with said stand and coöperating with said arm to hold the latter in its adjusted position.

14. In a spooling-machine, stands having bearings, a journal mounted in said stands, a winding-roller mounted loosely on said journal, dowel-pins occupying a position in said bearing to contact with the under sides of said journals, and means to automatically lift said dowel-pins to move the journals in the bearings and break the contact of the winding-roller from the drum employed to actuate it.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES F. FOSTER.

Witnesses:

A. F. LILLEY,

C. K. GAMBEON.

No. 655,617. Patented Aug. 7, 1900.

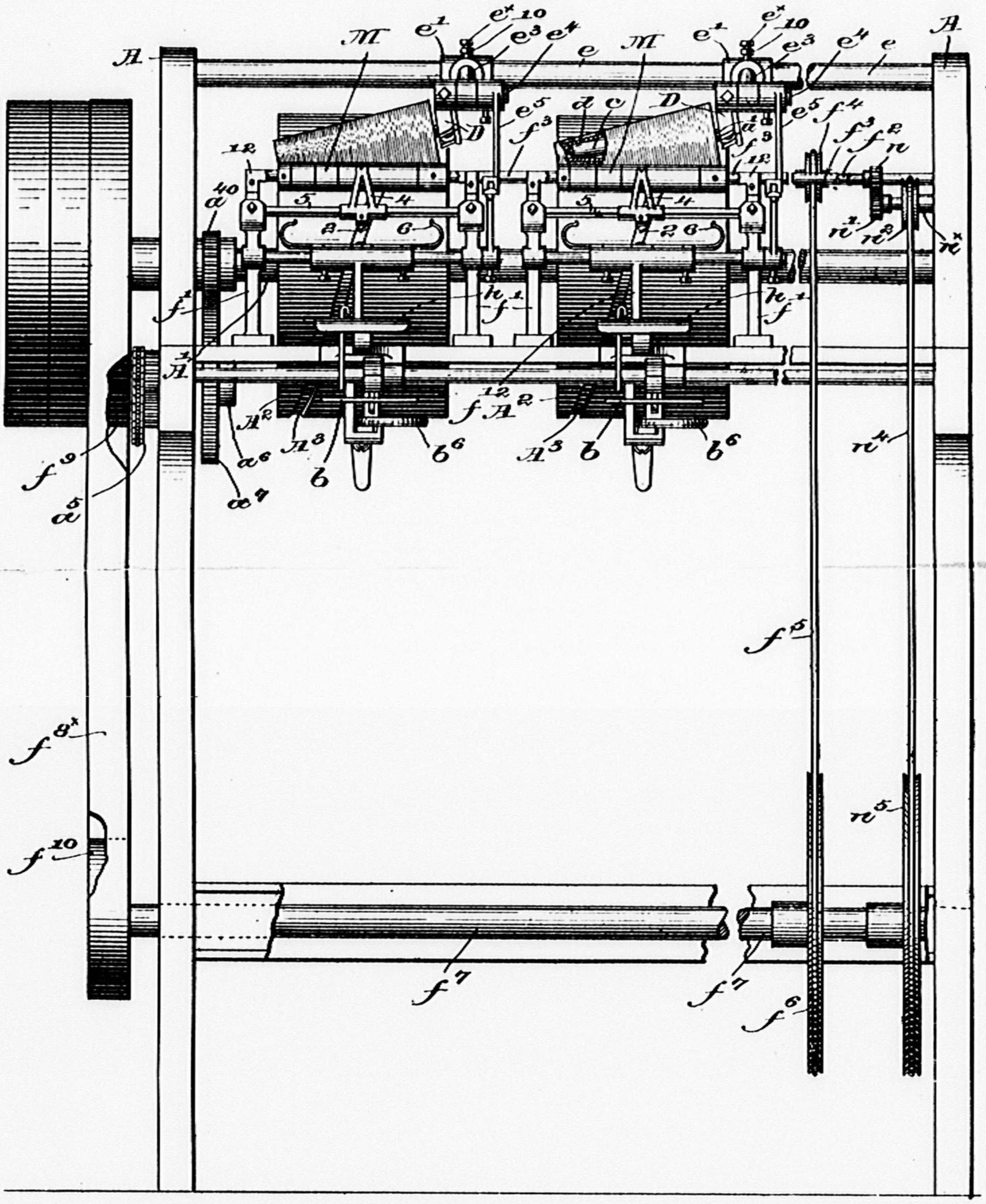
C. F. FOSTER.

SPOOLING MACHINE.

(Application filed Jan. 27, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses.
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SPOOLING MACHINE.

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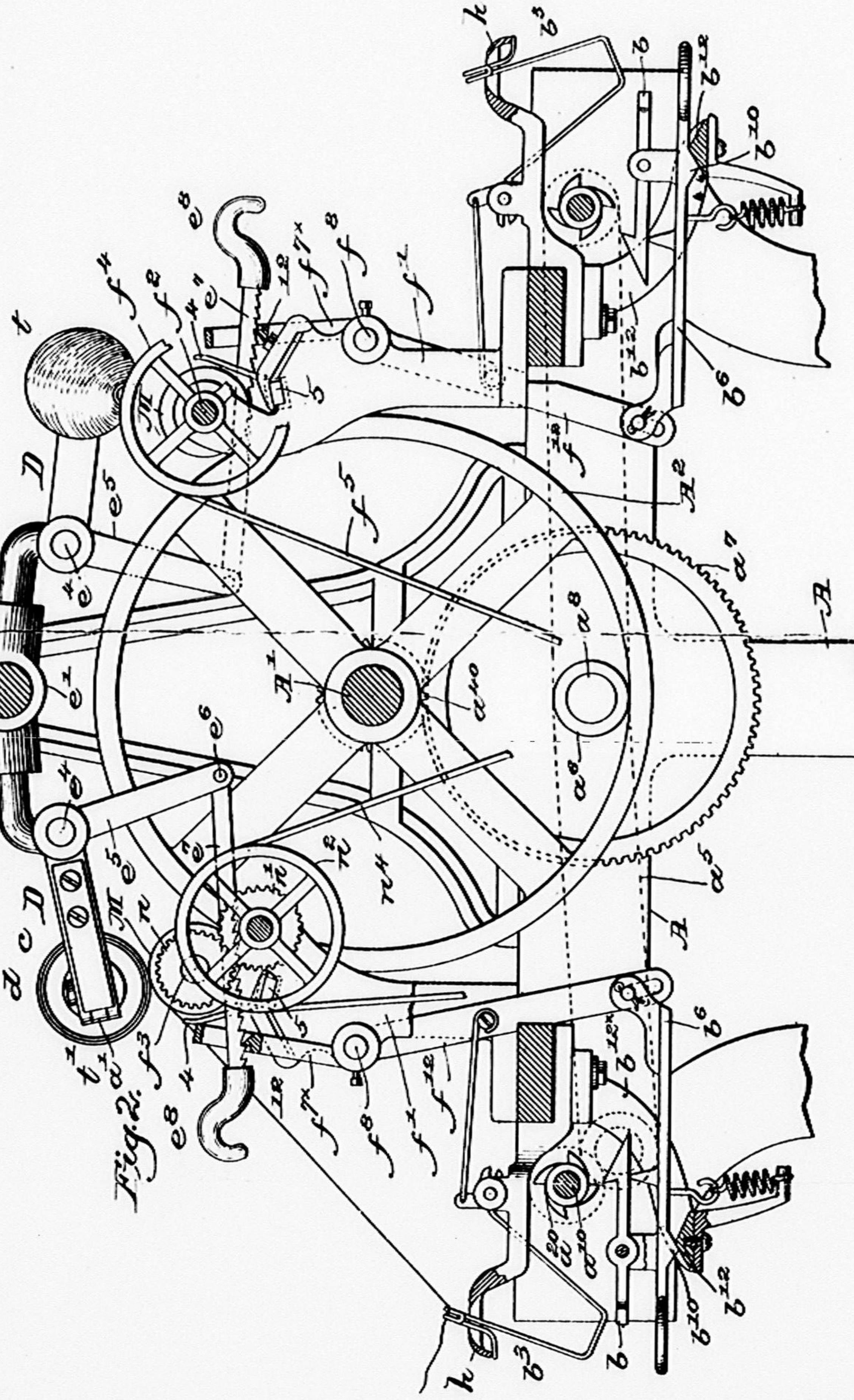

Fig. 2.

Witnesses.
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UNITED STATES PATENT OFFICE.

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SPOOLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 655,617, dated August 7, 1900.

Application filed January 27, 1900. Serial No. 2,932. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. FOSTER, a citizen of the United States, and a resident of Westfield, in the county of Hampden and State of Massachusetts, have invented an Improvement in Spooling-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters and numerals on the drawings representing like parts.

This invention has for its object the production of a novel machine for winding thread, yarn, silk, &c., either in cone or cylindrical form on suitable shells or tubes to be handled in machines in which the thread or yarn is used after winding.

The machine herein to be described is an improvement on the class of machine represented in United States Patent No. 535,616, dated March 12, 1895. In that machine the spindle supporting the carrier or tube carrying the shell or cylinder, usually of paper or other like material, to receive the material being wound is carried by a pivoted arm and the yarn mass is sustained upon and rotated by a roller deriving its movement by friction from a rotating drum provided with a suitable groove by which to reciprocate a thread-guide, and to stop the rotation of the spindle and yarn mass, whenever desired, the driving-roller is removed from contact with the periphery of said continuously-rotating drum.

In the machine referred to the thread-guide is reciprocated by or through a shoe connected therewith, which occupies a position in the spiral groove of the drum, and this shoe is frequently oiled, and at times there is too much oil applied in the groove, so that the oil gets onto the exterior of the drum and upon the driving-roller and is thence communicated to the thread or yarn being wound, thus injuring the same.

To obviate any possibility of the yarn being soiled by oil from the drum or from the driving-roller, I have herein provided to rotate the driving-rollers independently of the drums and to do this have applied the driving-rollers—a plurality of them—to one shaft driven positively by suitable gearing, to be described, and preferably there will be two or more such shafts, each having a plurality of driving-rolls contacting with each drum, that depending upon the number of simultaneous windings to be carried on in the machine. Herein I have also connected with the arms carrying the spindles referred to other arms, to which are attached notched or toothed rods adapted to be engaged either by hand or by a moving device actuated by or through the stop-motion mechanism on the breakage of thread to remove the yarn mass containing the broken thread from the roller employed to actuate it.

In the machine to be herein described the driving-rollers are rotated continuously whether the arms containing the spindles are in their operative or inoperative position.

Figure 1 is a partial cross-section representing a sufficient portion of a machine of well-known construction with my improvements added to enable my invention to be understood; and Fig. 2 is a partial front elevation of a machine containing my invention, the machine being broken out to save space on the drawing.

The framework A, the main shaft A' therein, the drum A^2, having suitable spiral grooves A^3, the rod e, supported in said framework and occupying a position parallel to said shaft A', the stands f', having suitable bearings to sustain a shaft to be described and also suitably shaped to receive a bar 5, on which is reciprocated the thread-guide 4, driven by means of a shoe 2, connected with said thread-guide loosely and entering the spiral groove of the drum, and the stop-motion devices, including the drop wire b^4, the notched lever b, the slide b^6, having at its under side a cam projection b^{10}, coöperating with the upper face of the cam b^{12}, sustained by a bracket $b^{12\times}$, the rotating shaft a^{10}, having the ratchet-wheel a^{20}, the lever f^{12}, forming the essential operative device of a stop-motion mechanism, the shaft a^{10} deriving its motion from a suitable sprocket-chain a^5, (shown by dotted lines in Fig. 2,) it surrounding a sprocket-gear a^6, connected with the hub of a gear a^7, mounted to turn about a stud a^8, held in the frame A, and deriving its motion from a toothed wheel a^{40} on the shaft A', are and may be all substantially as shown in another application, Serial No. 2,931, filed by me on the 27th day of January,

A. D. 1900, so said devices need not be herein more particularly described.

Herein I have provided the rod e with a plurality of hubs e', connected to said rods by suitable set-screws $e^{\times}$, said hubs receiving and sustaining adjustably by means of set-screws 10 the shanks of suitable supports e^3, having downturned ends which receive suitable fulcra e^4, on which is mounted suitable arms D, which may be substantially such as the arms represented in said application, each arm having, as therein provided for, a suitable spindle a', upon which is mounted a carrier or tube c, adapted to receive and hold a suitable shell, as d, preferably of conical shape, but which may be cylindrical or of any other form, according to the shape desired for the wound thread mass.

Each arm D has operatively connected with it an extension e^5, to the lower end of which is jointed at e^6 a bar e^7, represented as toothed or notched at its under side and provided near its outer end with a suitable knob or handle e^8 to be engaged by the operator.

Herein the lever f^{12} is connected, as provided for in said application, with a rock-shaft f^8; but instead of the arms therein represented as extended inwardly toward the axis of rotation of the drum and acting upon journal-lifters, shown as dowel-pins, I have provided the rock-shaft f^3 with arms, as $f^{7\times}$, one arm for each drum, and have extended said arms upwardly from said rock-shaft and provided each with a tooth 12, which is engaged positively by one of the teeth or notches of the bar e^7, so that whenever the lever f^{12} is moved by or through the operation of the stop-motion mechanism, which may be of any usual or suitable construction capable of moving the lever f^{12} whenever the thread breaks, the arm $f^{7\times}$ through its engagement with the bar e^7 will pull the said bar in the direction of the arrow thereon in Fig. 2 and immediately remove the thread mass from contact with the driving-roller. So, also, whenever the operator desires to remove the wound thread mass from contact with the driven roller to remove the mass, it having been wound to a predetermined size, or to apply a new shell, or to piece up ends, or for any other purpose he may pull the rod e^7 outwardly, drawing the teeth thereof over the tooth of the arm $f^{7\times}$, and by releasing the bar in any position desired the thread mass or its spindle may be placed at any desired distance from the winding-roll.

A series of winding-rollers M are mounted upon like shafts f^2 f^8, preferably a shaft at each side of the drum, and viewing Fig. 2 the shaft f^2 at the right-hand side of the drum has connected with it at one end a suitable belt-pulley f^1, which is driven by a belt f^5, passing over a pulley f^6 on a counter-shaft f^7, driven by a belt $f^{9\times}$, embracing pulleys f^9 f^{10}, respectively, on the main shaft A' and said counter-shaft. At the left-hand side of the drum, however, (see Fig. 1,) the shaft f^8, carrying the winding-rollers M, has mounted upon it near one end a pinion, as n, which is engaged by a second pinion n', suitably connected with a short shaft $n^{\times}$, suitably sustained in the frame end A and provided with a belt-pulley n^2, said belt-pulley receiving over it a suitable belt n^4, driven from a pulley n^5, also fast on the counter-shaft f^7, the two gears n and n' being employed for the reason that the rotation of the winding-rollers M must be in opposite directions in order to turn the thread masses t and t' in the directions of the arrows marked thereon in Fig. 2.

In a machine of the class described in the patent referred to it will be obvious that the speed of winding depends upon the surface speed of the winding-rollers driven by the drum; but at times it is desirable in some classes of work to be able to control the speed of the driving-rolls irrespective of the speed of the drum, as thereby the speed of the winding-rollers may be increased to a point which would not be practical if they derived their motion of rotation solely from the drum, and hence one reason for fixing a series of winding-rollers on one common driving-shaft and rotating said shaft independently of the drum.

It will be understood that the speed at which the winding-rollers may be driven may be determined at will by a change of the pulleys n^5 f^6 on the counter-shaft or by a change of the pulleys f^1 n^2, and this facility for changing the speed of rotation of the winding-rolls also enables me to change the direction of one coil or wind of thread or yarn with relation to another coil or wind, to thereby provide for any desired appearance of yarn in building up the yarn mass in conical or cylindrical form, it being understood that the appearance of the exterior of the yarn mass may be changed to suit by simply changing the relative speeds of rotation of the winding-roller with relation to the speed of reciprocation of the thread-guide.

The winding-rollers herein employed are supposed to be the same as indicated in said application—that is, they are composed of a sleeve having a fixed section and a plurality of loose sections—and the thread-guide at each end of its reciprocating stroke will meet a suitable spring, as 6, connected with a hub fixed on the rock-shaft f^3 and having the depending arm f^{12}, and the drop devices or detectors b^3 will move up and down through suitable rests h in usual manner and common to said application.

In Fig. 1 I have broken out from in front of the thread-guide the usual bar 12, partially shown as connected with the stand f', which acts against the outer side of the thread-guide, forming a track over which the thread-guide moves in its reciprocations, said guide being broken away to more clearly represent the winding-rollers M. The sleeves carrying the sections of the rollers are fixed to the shafts carrying them.

The bars e^7 are herein represented as notched and the arms $f^{7\times}$ as toothed, said teeth and notches forming a variable engaging device, and instead of said notches and teeth I may use any suitable or equivalent means whereby the bars and arms may be coupled together to operate with relation each to the other, as herein provided for.

In a machine where the rotation of the winding-rollers is stopped whenever the thread breaks, or if fully wound, the strain of starting up from a condition of rest a number of winding-rollers is considerable, and such strain in starting is done away with when the rollers are driven at all times.

By the term "spirality" of wind or winding I mean the separation of a thread laid once about the shell from the next layer wound on the shell.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a spooling-machine, a series of thread-guides, grooved drums for actuating the same, a shaft containing a plurality of sectional winding-rolls, means to rotate said shaft and its rolls, a plurality of arms having spindles to sustain shells upon which the thread or yarn is to be wound, stop-motion devices, and bars connected with said arms and operatively engaged by said stop-motion devices to remove the wound thread masses from contact with the driving-rolls on the breakage of the thread being wound.

2. A winding-roll, means to operate it, and an arm having an extension, a spindle mounted on said arm, and a carrier to receive and rotate a shell upon which thread or yarn is to be wound, combined with a bar connected with said extension, the movement of said bar removing the thread mass from contact with the driving-roll, and means coöperating with said bar to lock the latter in any position in which it may be left.

3. In a spooling-machine, a drum, means to support and rotate it, a series of thread-guides, means to reciprocate them, a shaft parallel with the axis of rotation of the drum, a plurality of sectional winding-rollers mounted on said shaft, means to rotate said shaft positively and with it said rolls, a series of arms one for each sectional roller, each arm having a spindle and carrying a shell to receive thread or yarn, and stop-motion devices to move said arms and remove the thread masses wound on said shells from driving contact with said winding-rollers leaving them at rest.

4. In a spooling-machine, a drum having a spiral groove, a thread-guide deriving its movement of reciprocation from said groove, means to move said drum at one speed, a shaft having a series of cylindrical rollers, a rotatable shaft independent of the drum-driving shaft, means connecting said independent shaft with the shaft carrying the driving-rollers to enable said shaft to be driven at any desired speed with relation to the speed of said drum, to thereby determine the degree of spirality of the windings, and spindles to carry each a shell to be rotated by said winding-rollers.

5. In a spooling-machine, a series of arms to sustain spindles provided with shells to receive thread or yarn, a shaft having a plurality of winding-rollers, means to rotate said shaft and the plurality of rollers carried thereby, each roller rotating a contacting shell or its yarn mass, a notched bar connected with each of said arms, and a series of stop-motion devices each having a tooth in engagement with said notched bar and adapted to remove a thread mass from contact with one of said rollers whenever a thread or yarn going to a thread mass breaks.

6. In a spooling-machine, a pivoted arm having an extension, a spindle mounted on said arm, a sustaining-carrier to receive and rotate a shell upon which thread or yarn is to be wound, combined with a toothed bar connected with said extension, the engagement and movement of said bar turning the arm carrying said spindle and putting the latter in its inoperative position.

7. In a spooling-machine, an actuating-shaft, a plurality of thread-guides mounted at opposite sides the longitudinal center of said shaft, means carried by said shaft to reciprocate said thread-guides, bearings located at opposite sides the longitudinal center of the thread-guide-actuating shaft, a plurality of roller-carrying shafts parallel with the thread-guide-actuating shaft, a series of winding-rollers carried by each of said roller-carrying shafts, an independent rotatable shaft, and means connecting it with and to rotate the roller-carrying shafts independently of the thread-guide-actuating shaft, whereby the speed of the roller-carrying shaft may be changed at will without necessarily changing the speed of the thread-guide-actuating shaft.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES F. FOSTER.

Witnesses:

A. F. LILLEY,

C. K. GAMBROSE.

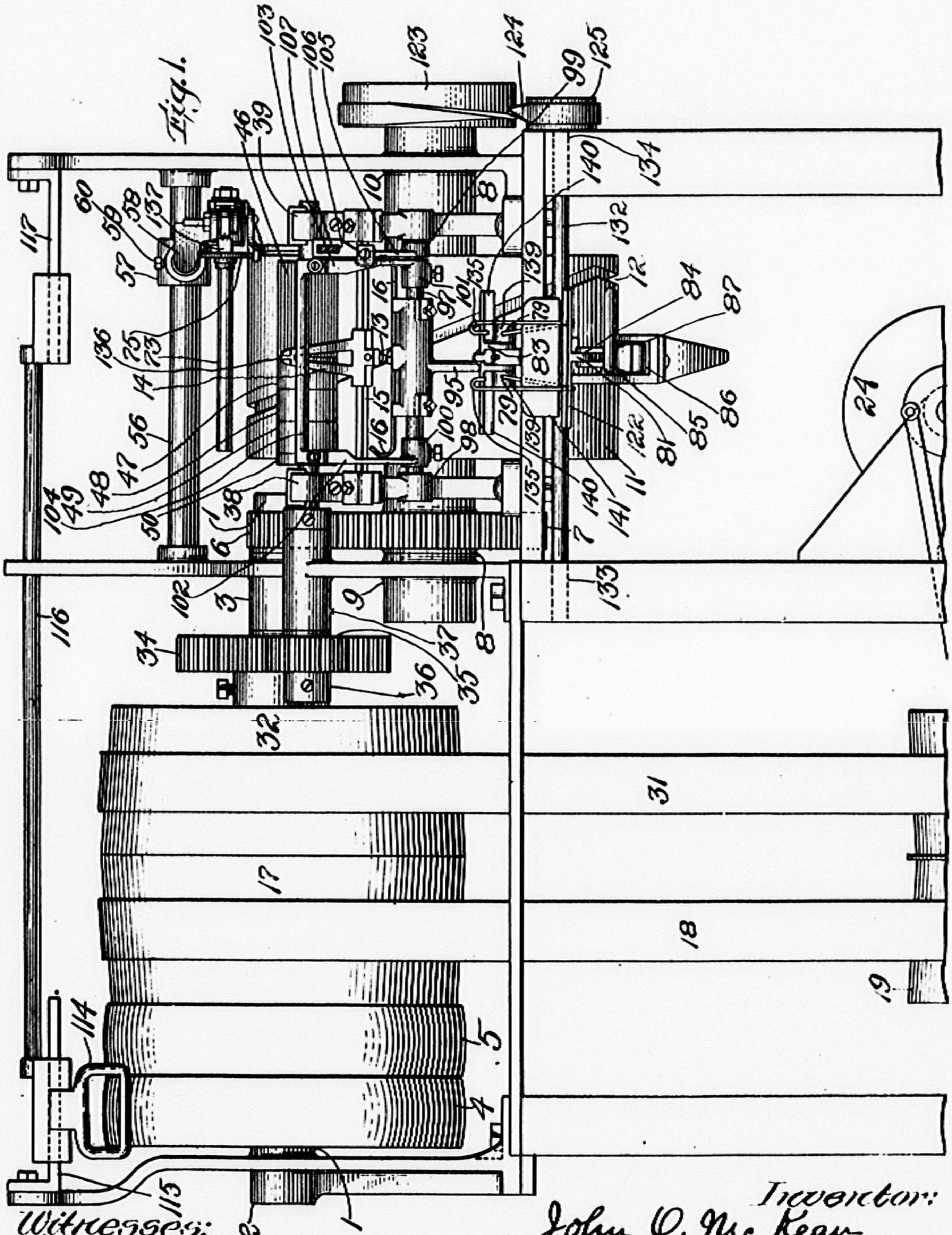
No. 716,923. Patented Dec. 30, 1902.

J. O. McKEAN.

WINDING MACHINE.

(Application filed Sept. 25, 1901.)

(No Model.) 4 Sheets—Sheet I.



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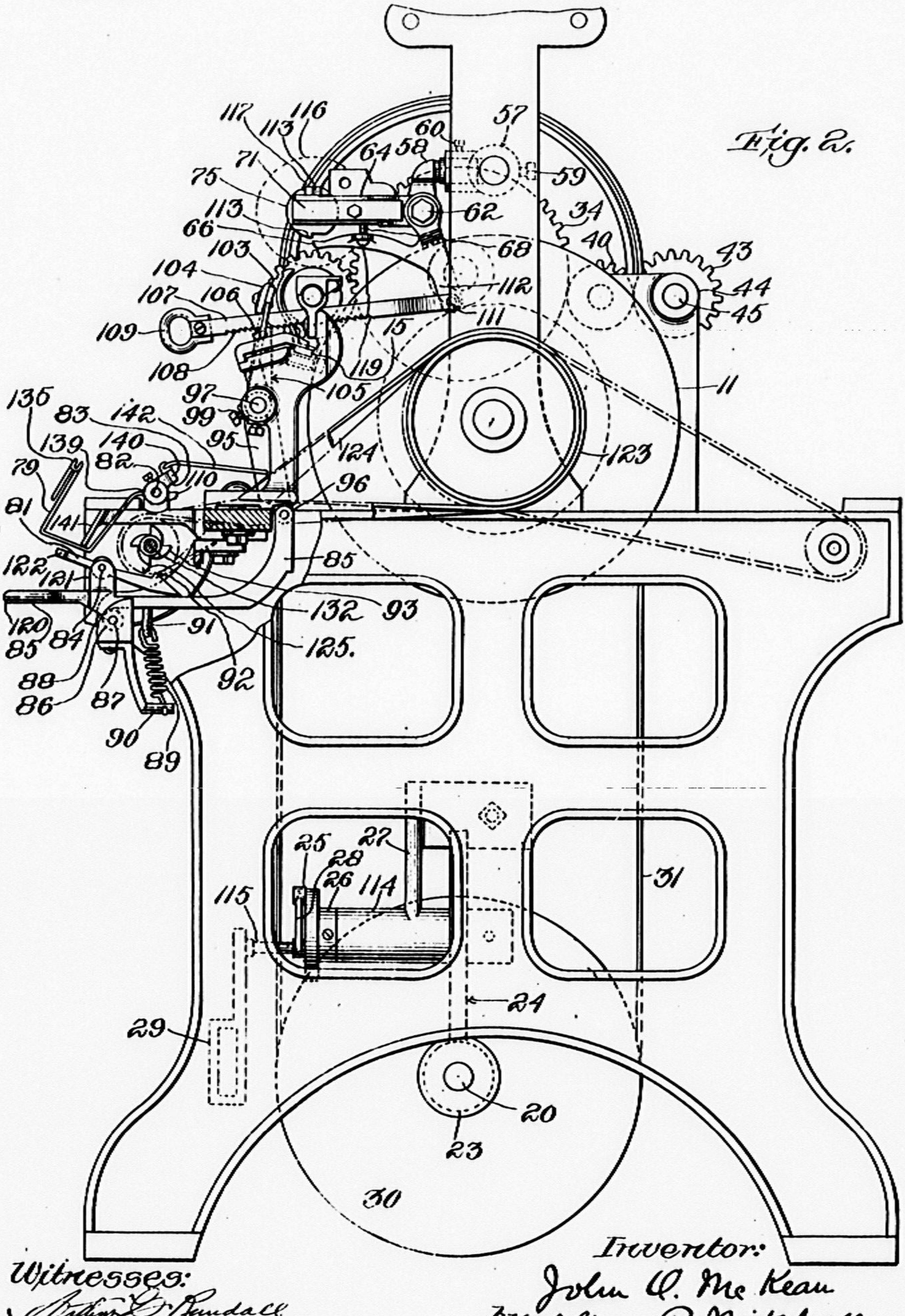
(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

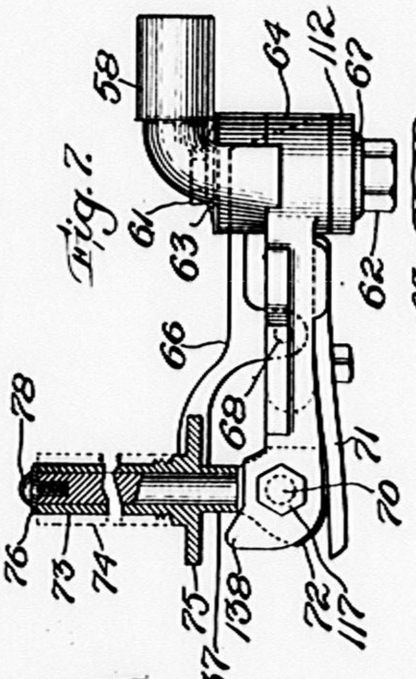

Fig. 7

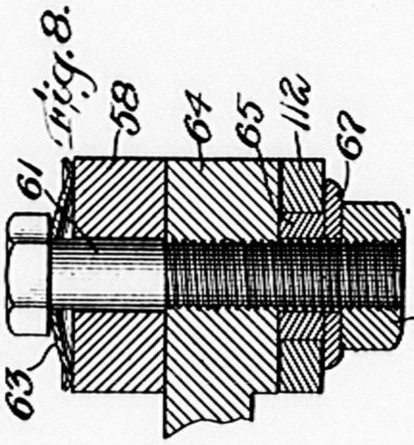

Fig. 8

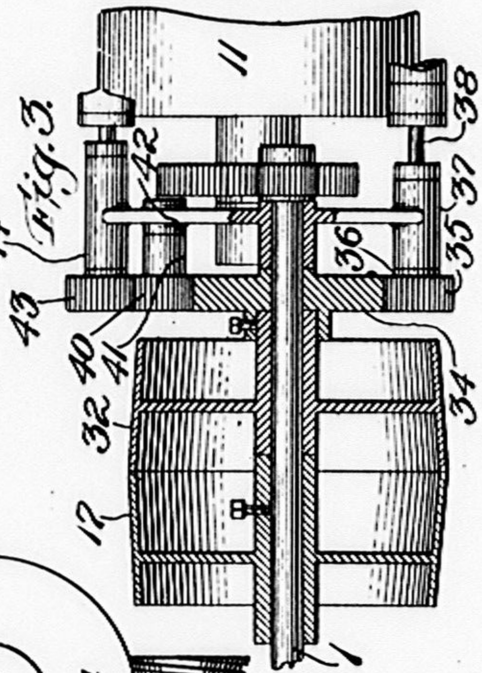

Fig. 3

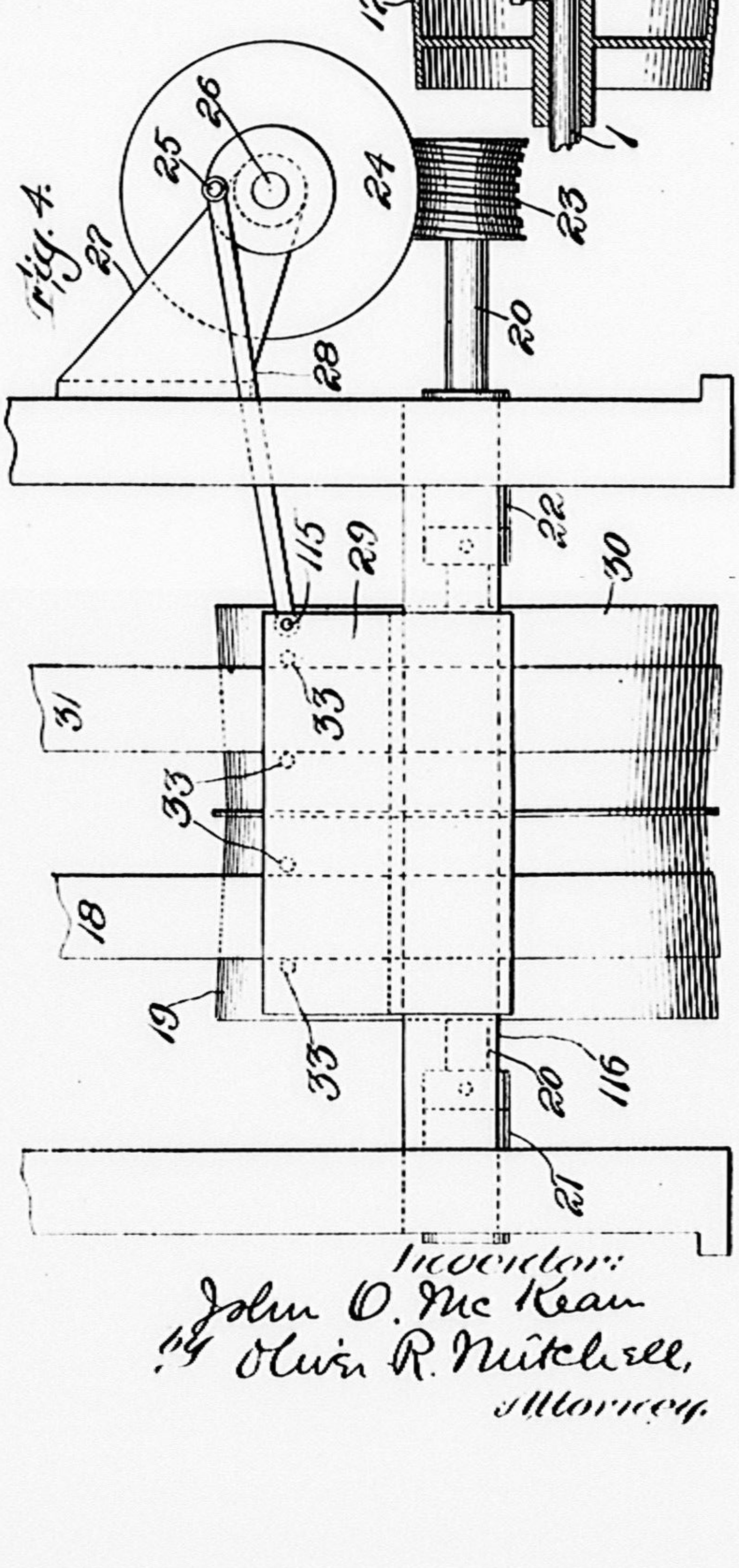

Fig. 4

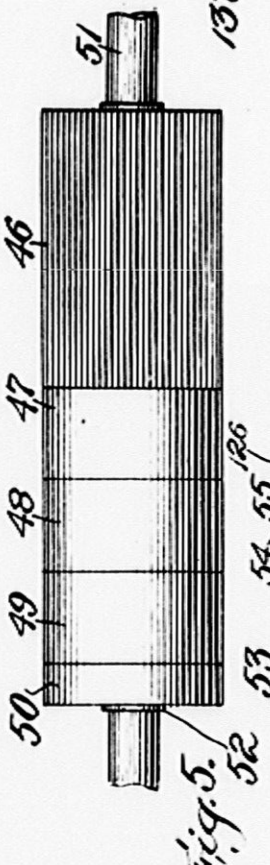

Fig. 5.

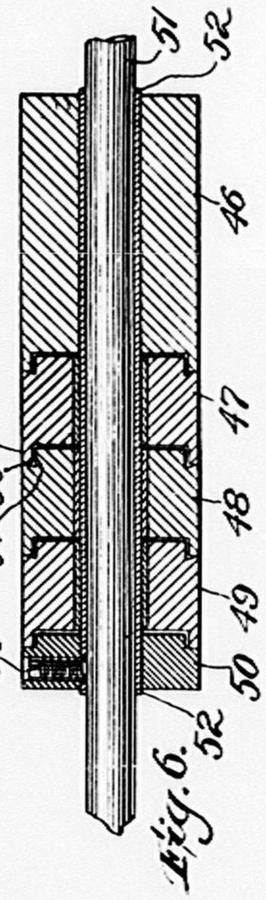

Fig. 6.

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WINDING MACHINE.

(Application filed Sept. 25, 1901.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 9.

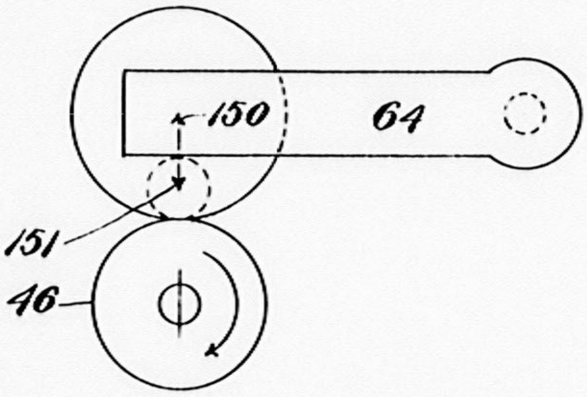
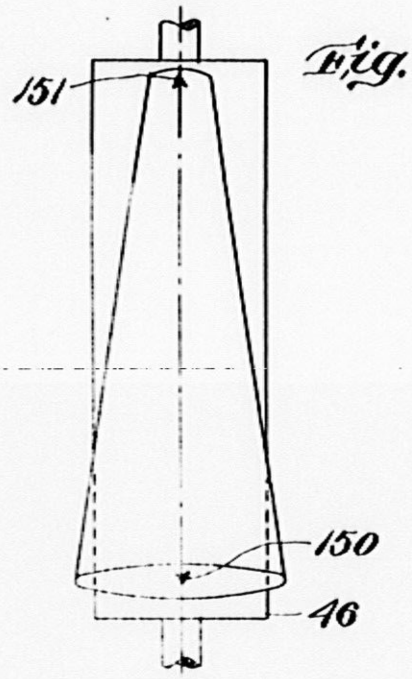


Fig. 10.



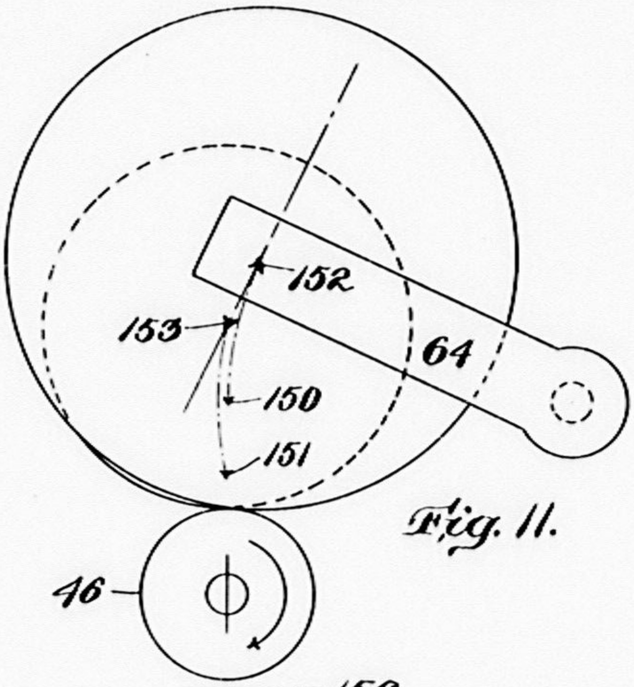
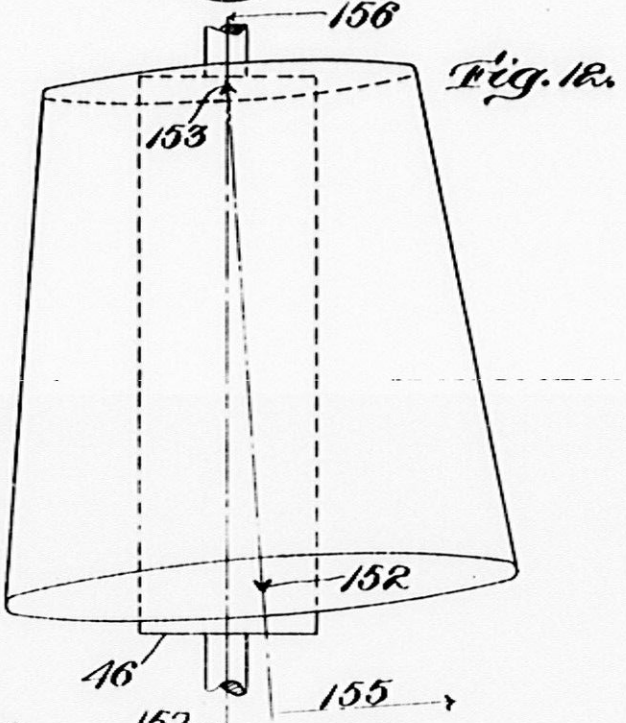


Fig. 11.

Fig. 12.



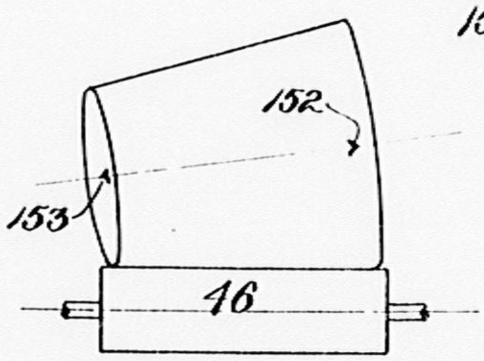


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Fig. 13.

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UNITED STATES PATENT OFFICE.

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WINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 716,923, dated December 30, 1902.

Application filed September 25, 1901. Serial No. 76,495. (No model.)

To all whom it may concern:

Be it known that I, JOHN O. McKEAN, of Westfield, in the county of Hampden and State of Massachusetts, have invented an Improved Winding-Machine, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of the upper part of a winding-machine embodying my invention, showing the spindle in position for winding a cylindrical cop. Fig. 2 is an end elevation of the same viewed from the right side of Fig. 1. Fig. 3 is a top view, partly in longitudinal section, of certain details of my machine. Fig. 4 is a front view of part of the speed-changing mechanism of my machine not shown in Fig. 1. Fig. 5 is a front view of the drive-roll in my machine. Fig. 6 is a partial longitudinal sectional view of this drive-roll. Fig. 7 is a top view of the spindle and the arms supporting it, shown partly in longitudinal section. Fig. 8 is a partial longitudinal sectional view of the joints between the arms shown in Fig. 7. Fig. 9 is a diagram showing an elevation of the position of a conical cop at the beginning of the wind, as seen from the right side of Fig. 1. Fig. 10 is a plan view of Fig. 9. Fig. 11 is a diagram showing an elevation of the position of a conical cop after the winding has progressed some time, as seen from the same point of view as Fig. 9. Fig. 12 is a plan view of Fig. 11. Fig. 13 is a front elevation of Fig. 11 on a reduced scale.

My invention relates to winding-machines, and especially to that class of winding-machines in which the cop is actuated by a drive-roll in contact with its surface and in which the thread-guide is reciprocated rapidly, so as to lay the thread obliquely upon the cop. In these machines each successive thread must be laid upon the cop at some distance from the last. Otherwise the threads would merely pile one on top of another and would not form a regular cop at all. This distance between successive threads on the cop is called the "gainage" and depends upon the relative speeds of the thread-guide and the cop. In machines in which the cop is driven by frictional contact of a drive-roll with its surface its speed varies inversely as its diameter. As the winding progresses the diameter of the cop increases very slowly, and the change in its speed is correspondingly slow. At various points in the winding the relative speeds of the cop and the thread-guide are such that the successive spirals are laid close side by side. This continues for a number of reciprocations of the thread-guide and forms a ridge of close-wound thread upon the cop. While this close wind is forming, the threads at the ends of the cop between the different parts of the ridge are left for some time without being bound in by other threads on top of them. At these exposed points the centrifugal force stretches the yarn, forming loops which fly out from the thread mass and break themselves upon the drive-roll. This is especially true when soft yarns are wound. In winding conical cops this tendency to form loops is very greatly increased, because the rotary force of the drive-roll is during a large part of the time applied to the cop obliquely and not at right angles to its axis. This tends to draw the threads toward one end and stretch them. One feature of my invention is to provide a machine which prevents the formation of these loops and the breakage of the threads resulting therefrom. To accomplish this, I provide automatic means to increase and decrease alternately the speed of the drive-roll, so that the variation in the relative speeds of the cop and thread-guide is rapid and the threads are at no time laid close side by side for more than two or three reciprocations of the thread-guide. Thus no ridge of close-wound thread can be formed, no threads are left unprotected long, and there is no opportunity for the formation of loops.

In winding a conical cop it is necessary to use a sectional drive-roll, the section at one end being fast upon the shaft and the rest free to revolve thereon. This avoids the twisting of the cop which would result from the use of a solid drive-roll. There must be sufficient clearance between the sections of the drive-roll to allow the sections to revolve freely at different speeds. When a thread breaks in winding, the end is frequently caught in the space between two of these sections and is drawn down and wound tightly around the shaft. This prevents the free revolution of the loose sections, and the machine must be stopped while the thread is removed. One feature of my invention is to provide a machine with a sectional drive-roll from which broken threads may be easily and quickly removed when they are drawn into the spaces between the sections. To accomplish this, I provide upon the end of each section a cylindrical portion of slightly smaller diameter than the drive-roll, and over this I lap the end of the next section. When a thread is drawn in between the two sections, it is wound around this smaller cylindrical portion and being near the surface may be easily extricated. This results in a great saving of time.

In all winding-machines it is necessary that the cop be stopped promptly when a thread breaks. This is commonly accomplished in machines in which the cop is surface-driven by raising the cop from the drive-roll automatically upon the breaking of a thread. In all machines of this character with which I am familiar the cop makes several revolutions from its own momentum after it is raised from the drive-roll before it comes to a full stop. When two threads are winding simultaneously on one cop, as is frequently done, and only one of them breaks, the other continues to wind and must be unwound back to the point of breaking and all that has been wound since the break must be broken off and thrown away. A third feature of my invention is to provide a machine in which the spindle is stopped upon the breaking of a thread before it has made more than a fraction of a revolution. To accomplish this, I provide a toothed disk upon the spindle near its base and a pawl which upon the breaking of a thread is pressed against the disk, raising the cop from the drive-roll and at the same time engaging one of the teeth on the disk, thus stopping the spindle within one revolution.

Referring to the drawings, 1 is the main driving-shaft, journaled on bearings 2 and 3 on the frame of the machine. Upon the shaft 1 are a loose pulley 4 and a tight pulley 5, adapted to be driven from a source of power. Shaft 1 carries also the spur-gear 6, which is tight on the shaft 1 and engages the spur-gear 7 upon the shaft 8. Shaft 8 is journaled upon bearings 9 and 10 upon the frame of the machine, and fast upon it is the cam 11. In the surface of the cam 11 is the oblique cam-groove 12, which engages the pin 13, which is attached to the thread-guide 14. Thread-guide 14 is adapted to reciprocate upon the bar or raceway 15, which is fast at its ends upon the frame of the machine and is parallel with the axis of the cam 11. At each end of its stroke the thread-guide strikes the spring 16, which is fast upon the shaft 97 and is wide enough to allow the thread-guide to strike it in any position which that shaft takes in the operation of the machine, as explained later. This relieves the jar which would otherwise result from the rapid reciprocation of the thread-guide. The upper end of the thread-guide is provided with a groove 136, through which the thread passes to the cop. This groove is merely a channel with straight sides and open at the top, so that the thread may be easily thrown out of it whenever desired. Cone-pulley 17 is fast upon shaft 1. This pulley is connected by belt 18 with cone-pulley 19, which is fast upon a shaft 20. Shaft 20 is parallel to shaft 1 and is journaled on bearings 21 and 22 upon the frame of the machine. It carries fast upon it the worm 23 and cone-pulley 30. This pulley 30 is connected by the belt 31 with cone-pulley 32, which is loose on shaft 1. The worm 23 engages spur-gear 24, which is fast upon shaft 26. Shaft 26 is horizontal and perpendicular to shaft 20 and is journaled upon a bearing 114 upon the arm 27, which is attached to the frame of the machine. Upon the shaft 26 is the crank 25, which reciprocates the shipper 29 through the crank-arm 28 and the pin 115. Shipper 29 is adapted to slide back and forth upon the square bar 116. Bar 116 is parallel to shaft 20 and is attached at its ends to the frame of the machine. Four pins 33 on shipper 29 engage belts 18 and 31, so that when the shipper is reciprocated both belts are shifted back and forth together. Cone-pulleys 17 and 32 are placed with their large ends together and pulleys 19 and 30 with their small ends together. Thus the shipping of the belts from one end to the other of the cones alternately raises and lowers the speed of the pulley 32. As will be readily seen, this goes on constantly while the machine is in operation. I have found these cone-pulleys and shipper compact and convenient; but the particular combination shown is not essential, and any automatic speed-changing device may be employed without affecting my invention.

Upon the hub of pulley 32 is spur-gear 34, which engages spur-gear 35 on shaft 36. Shaft 36 is parallel to shaft 1 and is journaled on bearings 37, 38, and 39 upon the frame of the machine. On it is the sectional drive-roll 46-52, which is described in detail below. This drive-roll is parallel to the path of motion of the thread-guide, and the latter reciprocates about an eighth of an inch from the surface of the drive-roll, with its upper end well above the center of the drive-roll. The drive-roll rotates in a direction such that its upper surface moves toward the cam. Between the cam and the drive-roll is a guard to prevent oil from the cam-groove from flying off against the drive-roll, and thus soiling the cop. This guard I have not shown in the drawings.

Directly over the cam 11 and parallel to the shaft 8 is the bar 56, attached to the frame of the machine. Upon this bar slides the block 57, which is held in any desired position by the set-screw 59. In this block is a hole perpendicular to the rod 56, in which hole fits the end of the arm 58, where it is held in place by the set-screw 60. Through the other end of arm 58 passes the bolt 61. When the machine is in operation, the arm 58 is so adjusted in the block 57 that the bolt 61 is parallel to the shaft 8 and the drive-roll. Arm 58 is loose upon bolt 61, which turns freely therein. After passing through arm 58 bolt 61 passes through a screw-threaded hole in arm 64, which arm is perpendicular to bolt 61. 65 is a washer which slips over the bolt 61 and serves as a bearing upon which swings arm 112. This arm is held in place by washer 67. The nut 62 screws upon the end of bolt 61; binding the washers 65 and 67 firmly together and acting as a check-nut to prevent the movement of arm 64 upon the bolt. Washer 65,is made thick enough so that arm 112 may move upon it with perfect freedom. Between arm 58 and the head of bolt 61 is the spring-washer 63. The tension between arm 58 and arm 64 may be regulated by turning bolt 61 in arm 64. The arm 64 is forked near its free end, and through the fork passes the bolt 70. Upon this bolt swings the stud 72, which is held in a position perpendicular to arm 64 by the spring 71. Upon stud 72 is the spindle 73, held in place by the washer 76 and the screw 78. Spindle 73 is free to rotate on stud 72 when in a position perpendicular to arm 64. The spindle is screw-threaded for a short distance near its base to hold in place a paper shell 74, upon which the thread is wound. Near the base of the spindle is a square portion 137, which engages a projection 138 on arm 64 when the spindle is swung forward from its normal position, holding the spindle firmly, so that it cannot revolve in either direction. While the spindle is thus held, the shell may be easily screwed on or off. Both cylindrical and conical shells are used. The forks of arm 64 may be placed so that the spindle makes any desired angle with the drive-roll 46–49. The drive-roll 46–49, the spindle 73, and the arm 64 are so placed with relation to one another that when the winding begins the shell is in contact with the drive-roll throughout its length, and as the winding progresses the increasing thread mass gradually swings up the arm 64, keeping always in contact with the drive-roll. The friction between arm 58 and arm 64 may be so varied by bolt 61, as above explained, that the friction between the drive-roll and the thread mass is just sufficient to cause them to revolve together. The thread-guide is so placed that the channel 136, from which the thread is fed, is reciprocated close to the line of contact of the thread mass and the drive-roll without touching either, and the thread is drawn in between them and thus pressed into its place immediately after leaving the thread-guide. When a cylindrical cop is wound, the spindle remains always parallel to the drive-roll, and the rotary force from the drive-roll is always applied in a direction perpendicular to the axis of the spindle. When a conical cop is to be wound, the spindle is so placed that when the winding begins the drive-roll and the shell are in contact along a line in the plane of their axes. This position of the cop is illustrated in Figs. 9 and 10. In these diagrams the axis of the cop is represented by line 150 151, which is in a plane with the axis of the drive-roll. The contact-line between the cop and the drive-roll is in the same plane, which is perpendicular to arm 64. The rotary force is thus applied to the cop at right angles to its axis. The spindle is not parallel to the drive-roll, but slants downward from arm 64. As the thread mass grows and swings arm 64 upward the axis of the spindle is gradually thrown out of the plane of the axis of the drive-roll. As has been explained, arm 64 swings upward on bolt 61, which is parallel to the drive-roll. It therefore swings in a plane perpendicular to the drive-roll, which is the plane on which Figs. 9 and 11 are projected. Whatever position arm 64 takes in this plane the relative position of line 150 151 and arm 64 will therefore remain the same—that is, the angle between them is always a right angle. As arm 64 swings from a horizontal toward a vertical position line 150 151 will swing from a vertical toward a horizontal position, each finally assuming the positions shown in Fig. 11. To look at the matter in another way, in Fig. 11 arcs 150–152 and 151–153 represent, respectively, the paths of point 150 and 151 as they swing upward. As the latter point starts behind the former and swings on a slightly-longer radius, the two points will never be in a vertical line after the start—that is, line 152 153 will gradually swing farther and farther from a vertical position. The effect of this swing on the relation of the cop to the drive-roll is shown clearly in Fig. 12, which is a plan view of the position shown in Fig. 11. Point 152 being now considerably to the right of point 153 is clearly outside the plane represented by 156 157, which passes through the axis of the drive-roll and point 153. The drive-roll and the cop are thus in the position of a skew-gear. The result is that the rotary force of the drive-roll is in this position applied not in a direction perpendicular to the axis of the cop shown by arrow 155, but slanting toward the large end in the direction of arrow 154. This tends to crowd the thread on the surface toward the large end of the cop, thus pulling the cop out of shape and stretching such threads as are exposed to the action of the drive-roll for any considerable number of revolutions without protection from other threads being wound on top of them. It is true that this tendency may be lessened somewhat by starting the wind with the arm 64 slanting downward, so that the cop is at angle with the drive-roll with the small end slightly back of the large end. Then as arm 64 swings up the cop will reach the position shown in Figs. 9 and 10 and then pass on toward the position of Figs. 11 and 12. During all the rest of the wind the rotary force is applied to the cop with a slant toward one end or the other, and this slant is sufficient, at least during considerable portions of the wind, to pull and stretch the threads on the surface. As a matter of fact, the cop and the drive-roll cannot possibly be in relation such that the rotary force is applied in a direction perpendicular to the axis except for one instant during the wind. This instant is when the cop and the drive-roll are in the position shown in Figs. 9 and 10 and may by adjustment be made to come at the beginning of the wind or at the end or at any intermediate point. At the end of the cop toward which this force tends this pulling action, together with centrifugal force, frequently stretches the yarn, so that large loops are formed which project beyond the end of the cop and are very liable to be broken, either by striking against the drive-roll or by catching on something when the cop is being handled after it is wound. To remedy this, I provide a machine in which the relative speeds of the thread-guide and the drive-roll are changing constantly and rapidly. In all machines of this type with which I am familiar the speed of the drive-roll is constant as compared with that of the thread-guide. The speed of a surface-driven cop varies inversely as its diameter. As the thread mass grows its speed slowly diminishes, and at several points in the winding the cop makes an exact number of revolutions during one stroke of the thread-guide. Assuming, for example, that at the beginning the cop makes between ten and eleven revolutions while the thread-guide passes once across it and back as its speed diminishes it will presently reach the point where it is making exactly ten revolutions during that time. At this point in the wind one spiral will be laid on top of the one preceding it, and the change of speed resulting from the growth of the cop alone is so gradual that for thirty or forty revolutions just before this point is reached and for a like number of revolutions thereafter the successive spirals will be laid very close together, producing about half a layer of close wind. During these sixty or eighty revolutions the strands not covered by this close wind are left unprotected, and the centrifugal force, added in the conical cops to the oblique pulling action of the drive-roll, described above, stretches the threads, and especially at the ends of the cop forms the loops mentioned above, which fly off and break themselves against the drive-roll. This is especially true in soft yarns. This close wind and the loops resulting from it will be repeated when the cop reaches, successively, the points where it makes nine, eight, &c., revolutions during one stroke of the thread-guide. In my machine by rapidly varying the speed of the cop I reduce to a minimum the time during which successive strands are laid close together, so that there is no long period when any of the threads are without the protection of other threads wound on top of them. It is obvious that the same results are accomplished if the speed of the drive-roll is constant and that if the thread-guide is changed or if the speed of one is made to increase while that of the other is diminishing, and vice versa; but the power necessary to actuate the cam and the thread-guide is much greater than that necessary to drive the spindle. It is therefore an advantage that the latter be driven through the cone-pulleys and not the former. This advantage is gained by the construction I have shown and described.

It is obvious that means to vary the relative speeds of the spindle and the thread-guide may be applied to winding-machines in which the spindle is central driven or is journaled on a carriage, as well as to the machine described above.

In practice I gear up from gear 34 to gear 35 in a ratio of three to one and down from gear 6 to gear 7 in the same ratio, and I make the pitch of the cone-pulleys such that while the thread-guide is going back and forth once the drive-roll makes about eight revolutions at its lowest speed and about ten at its highest. Gear 24 is made with sixty-five teeth, so that the drive-roll changes from its highest to its lowest speed once while the thread-guide is moving across and back about ten times, so that during each full stroke of the thread-guide the drive-roll makes, roughly, one-fifth of a revolution more or less than during the full stroke next preceding. This makes it impossible that any close wind be laid or that any threads remain long unprotected by threads laid on top of them binding them in. These proportions are not essential to my invention; but I have found that they are convenient and produce very good results.

The drive-roll in my machine is made in sections, as shown in detail in Figs. 5 and 6. On the shaft 51 fits the shell 52, which is of metal or other suitable material. Sections 46 to 49 are made, preferably, of wood. Section 46 is fast upon the shell 52. This is the driving-section, and its surface is corrugated longitudinally, as shown in Fig. 5, to give it a better hold on the cop. The other sections, 47, 48, and 49, are loose upon shell 52 and free to revolve thereon. They may be lined with metal where they bear upon shell 52 to reduce friction and give a better wearing-surface. Section 50 is a mere binder and is preferably made of metal. Through a screw-threaded hole in section 50 passes the binder-screw 53, which then passes through a hole in the shell 52 large enough to allow the binder to be moved back and forth on the shell for a short distance. By this screw the binder-section 50 is held in place on the shell 52 and the shell 52 on the shaft. When cylindrical cops are wound, the binder-section 50 may be moved up, so that no space is left between the various sections and all revolve together like a solid roll, each section acting as a driving-section.

When a conical cop is wound, it is obvious that its surface speed is greatest at the large end and gradually increases toward its small end. On the conical shell ordinarily used the diameter, and hence the surface speed at the small end, is only about one-third that at the large end. Obviously if a solid drive-roll were used one end must constantly slip on the shell or thread mass. This would result in a great loss of power and would twist and pull the cop out of shape. In winding conical cops therefore the binder-section 50 is so placed as to allow the loose sections 47, 48, and 49 to revolve on the shell 52 freely and at different speeds. This necessitates leaving some clearance between the various sections. Broken threads are frequently caught and pulled down between the sections and wound around the shell 52, preventing the free revolution of the loose sections. To remove these threads, the whole machine must be stopped, the sections separated, and the threads cut and broken away from the shell. This is a slow operation and a serious loss of time. In my machine I greatly lessen this loss of time by a new and original construction of the drive-roll. Between each two sections I make a broken or lap joint. Taking sections 47 and 48 as typical, I turn off one end of 48, leaving the shoulder 55 and the cylindrical portion 54 concentric with the rest and about a quarter of an inch smaller in diameter. Section 47 at the end adjacent to section 48 I cut away interiorly, leaving the annular rim 126, which laps over the small cylinder 54 and abuts at its outer surface against the shoulder 55, touching section 48 only at the outer surface of that shoulder. This construction makes the spaces between the sections as narrow as possible at the surface and lessens the likelihood of threads getting caught in them. Furthermore, it lessens the friction between the different sections. But the great advantage of this new construction is that when a thread is drawn into the spaces between two of the sections it merely winds itself around the cylinder 54, where it is very near the surface of the roll and may be reached and removed by the operator much more easily than when wound around the shell 52.

In all machines of this type it is important that the cop stop automatically whenever a thread breaks in winding. This calls the attention of the operator to the break, so that the ends may be pieced up without delay. When two threads are wound simultaneously upon the same cop, as is frequently done, it is especially important that the cop be stopped promptly if one thread breaks. In the machines of this kind with which I am familiar the stop-motion merely throws the broken thread out of the thread-guide and raises the cop from the drive-roll. The cop then makes several revolutions from its own momentum before coming to a full stop. If one thread remains unbroken, all that is wound after the break must be unwound, broken off, and thrown away. This results in a serious waste. To remedy this, I provide a stop-motion which throws the unbroken thread out of the thread-guide, raises the cop from the drive-roll, and at the same time applies a stop to the spindle, stopping it short within a single revolution.

Referring to the drawings, 75 is a disk which is fast upon and concentric with the spindle 73 near the end adjacent to the arm 64. In the periphery of this disk are one or more ratchet-teeth 113. These teeth are pointed in the direction in which the spindle revolves when the machine is in operation. 66 is a pawl adapted to engage the ratchet-teeth 113. This pawl extends forward from the arm 112, which is pivoted upon the washer 65 on the bolt 61 and is free to move on said washer in a plane perpendicular to the bolt 61. The screw 68 passes through a hole 119 in the pawl 66 and screws into the arm 64. This screw may be set so as to allow the pawl to swing down away from disk 75 as far as is desired. The rod 107 is attached to the lower end of the arm 112 by the bolt 111, on which it is free to swing in a plane perpendicular to the bolt 61. Upon the free end of this arm 107 is a handle 109.

97 is a shaft parallel to the drive-roll, with bearings on the frame of the machine at 98 and 99. The arms 102, 103, and 105 are fast to the shaft, extending upward in a direction perpendicular to the shaft 97. The upper ends of arms 102 and 103 are connected by the bar 104, which in its normal position is near to and just below the path of the feeding-groove of the thread-guide. Over this bar 104 the thread passes on its way to the thread-guide. In the arm 105 is the vertical slot 106, the lower end of which is beveled on its rear side. The arm 107 passes through this slot, and on its lower side are the ratchet-teeth 108, with their slanting sides toward the front. These teeth engage the lower end of the slot 106, so that when arm 105 is thrown forward arm 107 is drawn with it. The arm 95 is fast upon the shaft 97 and extends downward from it. At its free end it is connected by the bolt 96 with the rear end of the bar 85, which is free to move upon said bolt. The bar 85 slides backward and forward over the roller 86 on the pin 87. At its front end is the handle 120. At the point where the bar 85 strikes the roller 86 is the projection 88 on the bar 85.

89 is a spring attached to the bar 85 by the eye 91 and to the frame of the machine below the bar at 90. On the upper side of the bar are the two projecting lips 121, through which passes the pin 84. On this pin is pivoted the arm 81, which is so balanced that in its normal position its rear end lies upon the

bar and its front end is raised, as shown in Fig. 2. Across the front end of the arm 81 is the horizontal bar 122. At the rear end of arm 81 is the pawl 92. Directly over the pawl 92 is the ratchet-wheel 93, with the slanting side of the ratchet-teeth toward the rear of the machine when on the side next the pawl. The pawl is adapted to engage these teeth. This ratchet-wheel is fast on the shaft 132, which is journaled on bearings 133 and 134 on the frame of the machine. On the shaft 8 is the pulley 123. This is connected by the belt 124 with the pulley 125 on shaft 132, upon which is the ratchet-wheel 93. The elbow-shaped wires 79 are inserted at their rear ends in the blocks 139, which are pivoted on the pins 82, attached to the frame of the machine. On the rear side of each of these blocks are the lugs 110. Upon these pins 82 is pivoted the short arm 83, on the end of which is the cross-bar 140. The arm 83 is connected with arm 95 by a wire 142. At the free ends of the wires 79 are the hooks 135, through which the thread passes before passing over the bar 104. When the machine is in operation, the wires 79 are held up against cross-bar 141 by the threads which are being wound. If either thread breaks, the wire through which it passes drops upon the cross-piece 122 of the bar 81. This bar is so balanced that the weight of one of the wires 79 is sufficient to raise the rear end of the bar, bringing the pawl 92 into engagement with one of the teeth of ratchet-wheel 93, which is revolving, so that its teeth when on the under side are moving toward the rear of the machine. When the pawl 92 engages one of these ratchet-teeth, the bar 85 is drawn back so that the pawl passes out of the reach of the ratchet-teeth. This throws back the arm 95, drawing the cross-bar 140 downward. This presses down the lug 110 and raises the wire 79 to its normal position in contact with cross-bar 141. This allows pawl 92 to fall back to its normal position, in which it may be drawn forward again without engaging the ratchet-teeth 93. When arm 85 is drawn back, it also throws forward the bar 104 and the arm 105. The latter draws forward the rod 107 and the arm 112, raising the pawl 66, which strikes the disk 75, raising the cop from the drive-roll. Until a ratchet-tooth on disk 75 engages the pawl the latter merely acts as a brake on the spindle by its frictional contact with disk 75. When a tooth reaches the pawl, the spindle is stopped short. I have found in practice that two ratchet-teeth on the disk 75 produce the best results. This prevents more than half a revolution of the cop after the thread breaks. The forward movement of the bar 104, together with the raising of the cop, throws the unbroken thread out of the open groove in the thread-guide, which saves it from being broken by slatting back and forth after the cop has ceased to revolve. When the broken ends have been pieced up and the threads again drawn through the hooks on wire 79, the bar 85 is pulled forward by the handle 120. This raises cross-bar 140, leaving the wires supported against bar 141 only by the threads passing through them and free to drop when a thread breaks. Rod 107 is then pushed back. This disengages pawl 66 from the ratchet-tooth 113 and brings it down against the head of the screw 68, pressing the cop down upon the drive-roll. As the cop grows and the arm 64 is raised it draws with it the pawl 66, gradually throwing forward the arm 112 and the rod 107, whose ratchet-teeth allow it to slide through the slot 106. Obviously the same prompt stopping of the cop would be accomplished if two separate arms were employed to take the place of pawl 66, one of them raising the cop from the drive-roll and the other operating as a brake, both being actuated simultaneously by the breaking of a thread.

The disk 75 may be made without teeth and the pawl 66 may be adapted to make frictional contact with it, operating merely as a brake; but I regard the positive braking device above shown and described as preferable.

I am aware of patent to Parker No. 525,085, dated August 28, 1894, and disclaim all that is shown therein. The construction shown in that patent will operate only with a central driven spindle, in which the axis of the spindle is stationary during the winding. My device may be used equally well and is designed, primarily, for a machine with a surface-driven cop, in which the disk is constantly receding from the drive-roll as the cop grows. Moreover, in my device one arm may be made to perform both the function of a brake and the function of raising the cop from the drive-roll.

I have described and shown only one drive-roll, spindle, and thread-guide. In the machine as built the spur-gear 34 meshes with an idler spur-gear 40 on a stud 42, and that in turn meshes with spur-gear 43 on the shaft 45, which is journaled on the bearing 44 on the frame of the machine and is parallel to the cam-shaft 8. On this shaft 45 is another drive-roll exactly like the one already described. These two drive-rolls are in corresponding positions on opposite sides of the top of the cam 11. In connection with this rear drive-roll there are a thread-guide, a spindle, and other mechanism operating in the same way as those already described. In practice the cam-shaft and drive-roll shafts extend through a number of sections like that already described, each with its cam, drive-rolls, spindles, &c. Thus the speed-changing mechanism serves for many spindles. The cams are so arranged that no two thread-guides come to the end of a stroke at the same time. The jar resulting from the rapid reciprocation of many thread-guides is thus reduced to a minimum.

It is obvious that the automatic speed-changing mechanism above described may be applied to winding-machines in which the cop is central driven, as well as to those in which it is actuated by a drive-roll.

I claim—

1. In a winding-machine, a rotatable drive-roll; a thread-guide; a rotatable cam having a groove with which the thread-guide engages to reciprocate the thread-guide; means to rotate said cam; a rotatable spindle adapted to receive a shell for receiving the thread to be wound; means to keep the shell or thread mass on the spindle normally in contact with the drive-roll near the path of motion of the thread-guide, the spindle being movable away from the thread-guide by increase of the thread mass; a cone-pulley connected with the cam; a second cone-pulley connected with the drive-roll; means to actuate one of said cone-pulleys; a belt connecting the two cone-pulleys; a shipper adapted to engage said belt; a worm connected with one of the cone-pulleys; a worm-gear engaging said worm; a crank on said worm-gear; a crank-arm connecting said crank with the shipper to reciprocate the shipper, all so combined and arranged as to vary the relative speeds of the drive-roll and the thread-guide while the machine is in operation.

2. In a winding-machine, a rotatable drive-roll; a thread-guide; a rotatable cam having a groove with which the thread-guide engages to reciprocate the thread-guide; an arm adapted to swing in a direction approximately perpendicular to the axis of the drive-roll; a rotatable spindle journaled at or near the free end of said arm and adapted to receive a shell, for receiving the thread to be wound, the axis of the drive-roll being approximately in the path of motion of the spindle; means to keep the shell or thread mass upon the spindle normally in contact with the drive-roll near the path of the thread-guide; a cone-pulley connected with the cam; a second cone-pulley connected with the drive-roll; means to actuate one of the cone-pulleys; a belt connecting the two cone-pulleys; a shipper adapted to engage said belt; a worm connected with one of the cone-pulleys; a worm-gear engaging said worm; a crank on said worm-gear; a crank-arm connecting said crank with the shipper to actuate the shipper; all so combined and arranged as to vary the relative speeds of the drive-roll and the thread-guide while the machine is in operation.

3. In a drive-roll for a winding-machine, a shaft; two cylindrical sections of the same diameter placed side by side on said shaft and concentric therewith; the sections being free to revolve independently; one of the sections having on one end a central circular depression; the second section having at one end a reduced portion adapted to fit loosely in said depression; all so combined and coöperating as to prevent threads from being drawn down between the two sections below the lateral surface of the reduced portion of the second section.

4. In a winding-machine, a rotatable drive-roll; means to rotate said drive-roll; a rotatable spindle adapted to receive a shell for receiving the thread to be wound; means to keep the shell or thread mass upon the spindle normally in contact with the drive-roll, the spindle being movable away from the drive-roll by the increase of the wound mass; a disk fast upon and concentric with the spindle; teeth on the periphery of said disk; a pawl adapted to press against said disk and to engage said teeth; and means, set in motion by the breaking of a thread in winding, to actuate said pawl; all so combined and arranged that upon the breaking of a thread in winding, the pawl is brought into engagement with the teeth.

5. In a winding-machine, a rotatable drive-roll; means to rotate it; a rotatable spindle adapted to receive a shell for receiving the thread to be wound; means to keep the shell or thread mass upon the spindle normally in contact with the drive-roll; the spindle being movable away from the drive-roll by the increase of the wound mass; a disk fast upon and concentric with the spindle; an arm adapted to press against said disk; means set in motion by the breaking of a thread in winding to actuate said arm; all so combined and arranged that upon the breaking of a thread in winding the arm is pressed against the disk in a direction away from said drive-roll.

6. In a winding-machine, a rotatable spindle adapted to receive a shell for receiving the thread to be wound; means to rotate said spindle; a thread-guide; means to reciprocate said thread-guide; and automatic means to vary the relative speed of the thread-guide and the spindle while the machine is in operation, alternately increasing and diminishing the speed of one as compared with that of the other.

7. In a winding-machine, a rotatable drive-roll; means to rotate said drive-roll; a thread-guide; means to reciprocate said thread-guide; a rotatable spindle adapted to receive a shell for receiving the thread to be wound; means to keep the shell or thread mass upon the spindle normally in contact with the drive-roll near the path of the thread-guide, the spindle being movable away from the drive-roll and the thread-guide by increase of the thread mass; and automatic means to vary the relative speed of the drive-roll and the thread-guide while the machine is in operation, alternately increasing and diminishing the speed of one as compared with that of the other.

8. In a winding-machine, a rotatable drive-roll; means to rotate said drive-roll; a thread-guide; means to reciprocate said thread-guide; a rotatable spindle adapted to receive a shell for receiving the thread to be wound; means to keep the shell or thread mass upon the spindle normally in contact with the drive-roll near the path of the thread-guide, the spindle being movable away from the drive-

roll and the thread-guide by increase of the thread mass; and automatic means to vary the relative speed of the spindle and the thread-guide while the machine is in operation, alternately increasing and diminishing the speed of one as compared with that of the other.

9. In a winding-machine, a rotatable drive-roll; means to rotate said drive-roll; a thread-guide; means to reciprocate said thread-guide; an arm adapted to swing in a direction approximately perpendicular to the axis of the drive-roll; a rotatable spindle journaled at or near the free end of said arm and adapted to receive a shell for receiving the thread to be wound; the axis of the drive-roll being approximately in the path of movement of the spindle; means to keep the shell or thread-mass upon the spindle normally in contact with the drive-roll near the path of the thread guide, the spindle being movable away from the drive-roll by increase of the thread mass; and automatic means to vary the relative speeds of the drive-roll and the thread-guide while the machine is in operation, alternately increasing and diminishing the speed of one as compared with that of the other.

10. In a winding-machine, a rotatable drive-roll; means to rotate said drive-roll; a thread-guide; means to reciprocate said thread-guide; an arm adapted to swing in a direction approximately perpendicular to the axis of the drive-roll; a rotatable spindle journaled at or near the free end of said arm and adapted to receive a shell for receiving the thread to be wound; the axis of the drive-roll being approximately in the path of movement of the spindle; means to keep the shell or thread mass upon the spindle normally in contact with the drive-roll near the path of the thread-guide, the spindle being movable away from the drive-roll by increase of the thread mass; and automatic means to vary the relative speeds of the spindle and the thread-guide while the machine is in operation, alternately increasing and diminishing the speed of one as compared with that of the other.

11. In a winding-machine, a rotatable drive-roll; a thread-guide; a rotatable cam having a groove with which the thread-guide engages to reciprocate the thread-guide; means to rotate said cam; a rotatable spindle adapted to receive a shell for receiving the thread to be wound; means to keep the shell or thread mass on the spindle normally in contact with the drive-roll near the path of motion of the thread-guide, the spindle being movable away from the thread-guide by increase of the thread mass; a cone-pulley connected with the cam; a second cone-pulley connected with the drive-roll; means to actuate one of said cone-pulleys; a belt connecting the two cone-pulleys; a shipper adapted to engage said belt; a worm connected with one of the cone-pulleys; a worm-gear engaging said worm; a crank on said worm-gear; a crank-arm connecting said crank with the shipper to reciprocate the shipper, all so combined and arranged as to vary the relative speeds of the drive-roll and the thread-guide while the machine is in operation, alternately increasing and diminishing the speed of one as compared with that of the other.

12. In a winding-machine, a rotatable drive-roll; a thread-guide; a rotatable cam having a groove with which the thread-guide engages to reciprocate the thread-guide; means to rotate said cam; a rotatable spindle adapted to receive a shell for receiving the thread to be wound; means to keep the shell or thread mass on the spindle normally in contact with the drive-roll near the path of motion of the thread-guide, the spindle being movable away from the thread-guide by increase of the thread mass; a cone-pulley connected with the cam; a second cone-pulley connected with the drive-roll; means to actuate one of said cone-pulleys; a belt connecting the two cone-pulleys; a shipper adapted to engage said belt; a worm connected with one of the cone-pulleys; a worm-gear engaging said worm; a crank on said worm-gear; a crank-arm connecting said crank with the shipper to reciprocate the shipper, all so combined and arranged as to vary the relative speeds of the spindle and the thread-guide while the machine is in operation, alternately increasing and diminishing the speed of one as compared with that of the other.

13. In a winding-machine, a rotatable drive-roll; a thread-guide; a rotatable cam having a groove with which the thread-guide engages to reciprocate the thread-guide; an arm adapted to swing in a direction approximately perpendicular to the axis of the drive-roll; a rotatable spindle journaled at or near the free end of said arm and adapted to receive a shell, for receiving the thread to be wound, the axis of the drive-roll being approximately in the path of motion of the spindle; means to keep the shell or thread mass upon the spindle normally in contact with the drive-roll near the path of the thread-guide; a cone-pulley connected with the cam; a second cone-pulley connected with the drive-roll; means to actuate one of the cone-pulleys; a belt connecting the two cone-pulleys; a shipper adapted to engage said belt; a worm connected with one of the cone-pulleys; a worm-gear engaging said worm; a crank on said worm-gear; a crank-arm connecting said crank with the shipper to actuate the shipper, all so combined and arranged as to vary the relative speeds of the drive-roll and the thread-guide while the machine is in operation, alternately increasing and diminishing the speed of one as compared with that of the other.

14. In a winding-machine, a rotatable drive-roll; a thread-guide; a rotatable cam having a groove with which the thread-guide engages to reciprocate the thread-guide; an arm adapted to swing in a direction approximately perpendicular to the axis of the drive-roll; a rotatable spindle journaled at or near the free

end of said arm and adapted to receive a shell for receiving the thread to be wound, the axis of the drive-roll being approximately in the path of motion of the spindle; means to keep the shell or thread mass upon the spindle normally in contact with the drive-roll near the path of the thread-guide; a cone-pulley connected with the cam; a second cone-pulley connected with the drive-roll; means to actuate one of the cone-pulleys; a belt connecting the two cone-pulleys; a shipper adapted to engage said belt; a worm connected with one of the cone-pulleys; a worm-gear engaging said worm; a crank on said worm-gear; a crank-arm connecting said crank with the shipper to actuate the shipper, all so combined and arranged as to vary the relative speeds of the drive-roll and the thread-guide while the machine is in operation alternately increasing and diminishing the speed of one as compared with that of the other.

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No. 867,153. PATENTED SEPT. 24, 1907.

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BALLING MACHINE.

APPLICATION FILED MAY 2, 1907.

2 SHEETS—SHEET 2.

Fig: 3.

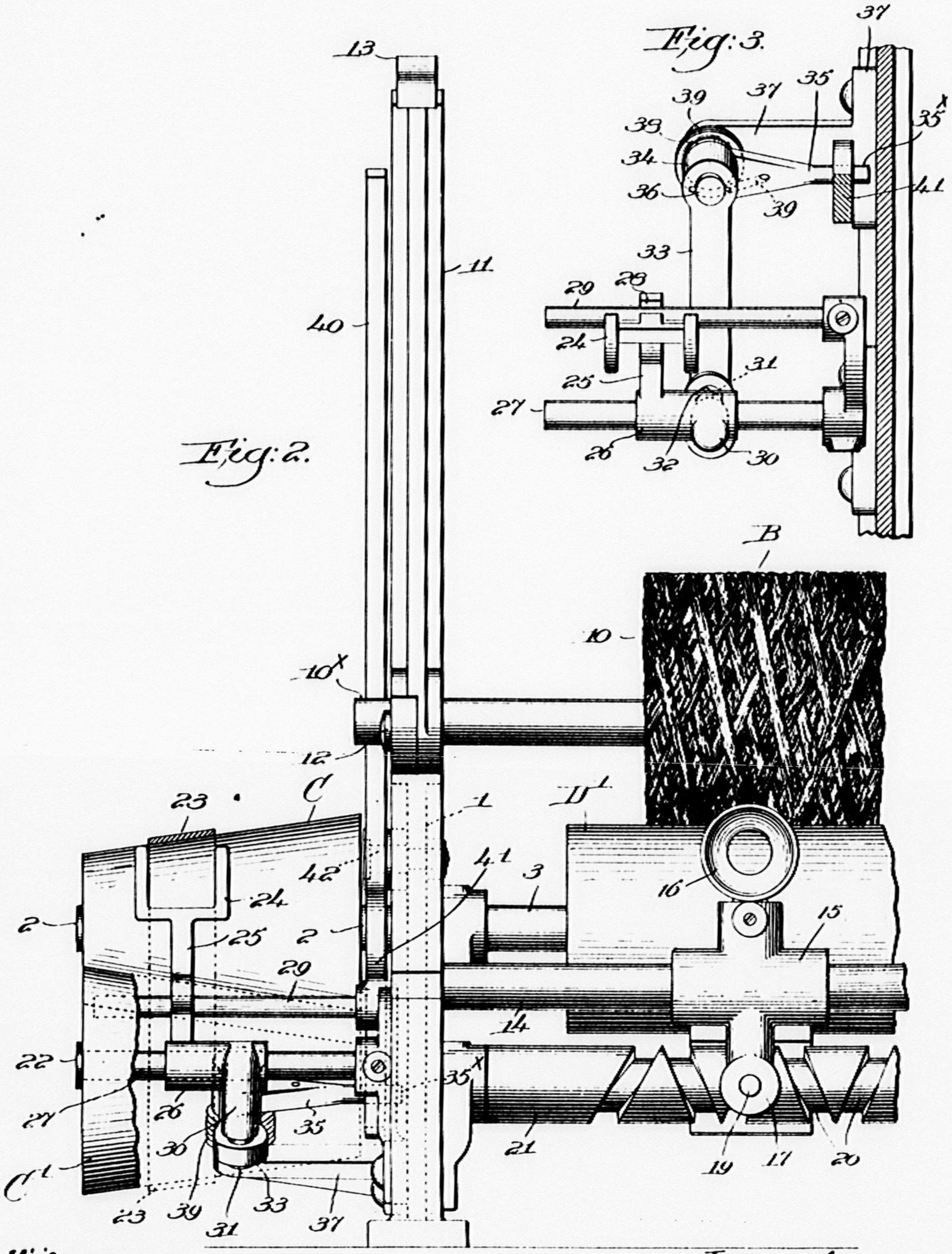

Fig: 2.

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No. 867,153. PATENTED SEPT. 24, 1907.

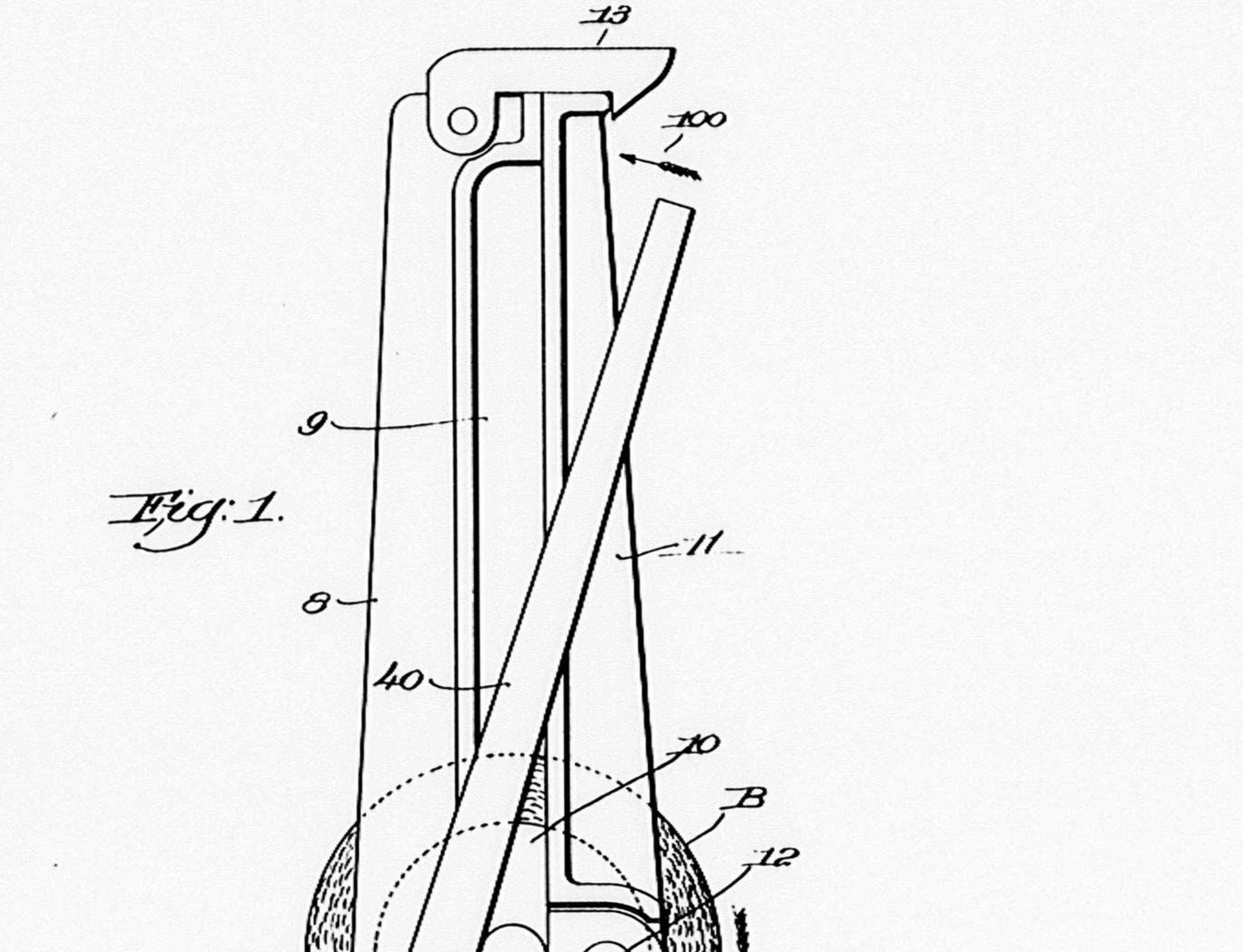
A. E. RHOADES.

BALLING MACHINE.

APPLICATION FILED MAY 2, 1907.

2 SHEETS—SHEET 1.

Fig: 1.



Witnesses,
Edward F. Allen.
Joseph M. Ward

Inventor;
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UNITED STATES PATENT OFFICE.

ALONZO E. RHOADES, OF HOPEDALE, MASSACHUSETTS, ASSIGNOR TO DRAPER COMPANY, OF HOPEDALE, MASSACHUSETTS, A CORPORATION OF MAINE.

BALLING-MACHINE.

No. 867,153. **Specification of Letters Patent.** **Patented Sept. 24, 1907.**

Application filed May 2, 1907. Serial No. 371,366.

To all whom it may concern:

Be it known that I, ALONZO E. RHOADES, a citizen of the United States, and a resident of Hopedale, county of Worcester, State of Massachusetts, have invented an Improvement in Balling-Machines, of which the following description, in connection with the accompanying drawing, is a specification, like letters on the drawing representing like parts.

This invention relates to winding apparatus of the type wherein a number of yarns or threads taken from spools or bobbins on a creel are gathered together into what is technically termed a "chain" and wound spirally upon a beam or roll to form a ball.

The yarn mass or ball should be of uniform diameter from end to end, and in apparatus of this general type, one example of which forms the subject matter of United States Patent No. 379,616, granted to Straw March 20, 1888, the chain or rope of yarns is led through a traversing guide-eye or trumpet. Such guide-eye is operated by a traverse-screw and effects the laying of the chain of yarn helically from end to end of the ball. In said patent the thread of the double or crossing screw-shaft which effects the traverse of the guide or trumpet is made with a steeper pitch at the ends than at the intermediate portion, to insure a quick reversal of the trumpet and thereby avoid undue accumulation of the yarn chain at the ends of the ball. The screw-shaft is rotated at constant speed, however, from the beginning of the winding to the end thereof, and while the balls so made are very satisfactory in general there are times when the tendency of the ball to bulge at the ends is still found to occur. The cylinders or drums on which the ball rests and by which it is rotated during the winding rotate at a constant speed, and while the diameter of the ball gradually increases its surface speed remains constant, but the revolutions of the ball per revolution of the drums gradually decreases. Consequently, if the speed of the traversing screw-shaft is constant throughout the winding the angle at which the rope or chain is laid upon the ball will not vary as the diameter of the latter increases, but the spirals will be longer and farther apart. That is, the distance between the adjacent spirals of the winding on a smaller diameter will be less than it will be between adjacent spirals on a larger diameter, so that there is more tendency for the yarn to pile up on itself and less tendency for each layer to firmly bind the yarn previously wound into the general mass of the ball. In my present invention I have devised means to overcome this tendency by varying the pitch of the winding during the winding operation, and this is effected by automatically changing the ratio between the speed of the traverse and the surface speed of the ball.

The various novel features of my invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

In practice the yarn or thread, taken from the spools or bobbins of the creel-frame in usual manner, is led through the reed and over and under usual rolls of the warping-machine of suitable construction, neither the creel-frame nor the warping-machine being shown herein as they are well-known in the art and form no part of this invention. From the warping-machine the sheet of yarn or thread is gathered into a rope or chain, as usual, and led to the balling machine, either directly or after passing through a measuring mechanism, such for instance as forms the subject matter of United States Patent No. 815,378 granted to me March 20, 1906.

I will now describe in detail one practical embodiment of a balling machine in accordance with my present invention.

Figure 1 is a left hand side elevation of a balling machine embodying my invention, the ball being shown in process of winding; Fig. 2 is a partial elevation thereof viewing Fig. 1 from the right, the right hand side of the machine frame being omitted to save space and as it is practically a duplication of the frame at the left; Fig. 3 is a top plan view of the variable speed mechanism and the means whereby it is controlled automatically during the winding of the ball.

Referring to the drawings, the sides 1 of the main frame are of suitable size and shape to provide bearings for two shafts 2 and 3, on which are mounted the driving drums D and D′, arranged in parallelism a short distance apart and between the frame sides, the latter being substantially alike, and only one side frame is illustrated in the drawings. The drum shafts have fast thereon gears 4, 5, see full and dotted lines Fig. 1, at the right hand side of the machine, viewing Fig. 2, meshing with an intermediate gear 6 rotatable on a stud 7, Fig. 1, on the right hand side of the frame. Upright standards 8 on the frame sides are each provided with an elongated open slot 9, extending at its lower end into the adjacent frame side, at $9^{\times}$, see Fig. 1, to receive the journals $10^{\times}$ of the roll or cylinder 10 on which the ball of yarn is wound, the open slots being closed by arms 11 fulcrumed at 12 on the main frame and each held in operative position by a lock or catch 13.

It will be seen by reference to Fig. 1 that the driving drums are rotated in the same direction and at the same speed, as they are equal of diameter, and the balling roll 10 is supported thereby and said roll and the ball, as it is formed thereupon, will be rotated by surface contact with the drums. The upright guideways 9, $9^{\times}$ for the roll journals $10^{\times}$ are located midway between the axes of the drums D, D′, as herein shown, and as the diameter of the ball increases the roll journals will gradually rise in said guideways. A horizontal transverse rod or bar 14 rigidly mounted in the frame sides in front of and below the shaft 3 of drum D′ has slidably mounted upon it a sleeve-like carriage 15 having attached to it a guide-eye or trumpet 16, through which the rope or chain of yarn is led and by lateral movement of said guide-eye the chain is traversed upon the ball.

In Figs. 1 and 2 the ball in process of formation is shown at B. A depending portion 17 of the carriage 15 forms a bearing for a follower 18, see dotted lines Fig. 1, the shank 19 of the follower being swiveled in the bearing, so as to permit the follower to coöperate with the double or crossing threads 20 on a rotatable traverse shaft 21, mounted in bearings on the frame sides.

The mechanism so far described is in its essential features substantially the same as shown and described in Patent No. 379616 before referred to, and in practice the threads on the traverse shaft are made of steeper pitch at the ends than at the intermediate portions, to effect a quick reversal of the carriage at each end of its stroke, as and for the purpose set forth in said patent.

In the present embodiment of my invention the drums D and D′ are driven at a constant speed during the operation of winding a ball, and the traverse shaft 21 is rotated at a gradually decreasing speed as the diameter of the yarn-mass or ball B increases. I have not shown herein the driving connections for the drums, as the same may be of any convenient character, such for instance as in Patent No. 379,616.

At the left hand side of the machine the shaft 2 is extended beyond the frame side, and a speed cone C is fixedly secured thereto, tapering outwardly, and an opposite reversed speed-cone C′ is fixedly secured to the extension 22 of the traverse shaft 21, outside of the frame side, as clearly shown in Figs. 1 and 2. Said cones are connected by a transmitting belt 23, and by shifting the belt along the cones the speed of rotation of the traverse shaft 21 will be varied, according to the direction the belt is shifted, it being understood that the cone C is the driving member and the cone C′ the driven member of the speed-changing mechanism.

It will be manifest that the surface speed of the ball remains constant as the diameter of the ball increases, and in order to change the ratio between the surface speed of the ball and the speed of the traverse during the winding operation I have provided means herein to gradually decrease the rotative speed of the traverse shaft 21 as the diameter of the ball increases.

Referring to the drawings the belt-shifter comprises a fork 24 on the upper end of a bent arm 25 terminating at its lower end in a lateral sleeve-hub 26 slidably mounted on a rigid guide-rod 27 extended from the frame side between the speed-cones. The bent arm 25 is slotted at 28, Fig. 1, to loosely embrace a second guide-rod 29, secured to and projecting from the frame side, so that the fork 24 can be moved in parallelism to the axes of the cones C and C′. The hub 26 has a depending extension 30 terminating in a cylindrical portion 31 which is extended loosely into a longitudinal slot 32 in a long arm 33 fast on a hub 34 which has a short arm 35, shown substantially at right angles to the arm 33, the two arms constituting a bell-crank.

As shown in Fig. 1 the hub 34 of the bell-crank is mounted on a spindle 36 forming part of a bracket 37 bolted to the frame side 1, the lower portion of the spindle being enlarged at 38 to form a seat for the hub and having coiled around it a spring 39. One end of the spring is fixed and its other end is connected with the bell-crank, the winding of the spring being such that it tends to swing inward the long arm 33 and move the hub 26 and belt-fork 24 to the right, Fig. 2, to thereby shift the belt 23 toward the larger end of cone C and the smaller end of cone C′. The bracket-spindle 36 is inclined, Fig. 1, so that the path of movement of the arm 33 is in a plane at right angles to the extremity 31 of the hub extension 30, thereby obviating any tendency to bind in the slot and pin connection between the bell-crank and the hub 26.

In order that the belt-shifter may be controlled or governed in accordance with the diameter of the ball being wound I have provided a controller, shown as a lever 40, 41 fulcrumed on a stud 42 on the frame side, the longer arm 40 being upturned close to the standard 8 on said frame side and resting upon the adjacent journal $10^{\times}$ of the balling-roll 10. The shorter arm 41, see dotted lines Fig. 1, is bent to at all times clear the shaft 2, and at its lower end is slotted at 43 to receive the stud-like end $35^{\times}$ of the short arm 35 of the bell-crank.

Viewing Fig. 1 it will be obvious that as the diameter of the ball B increases the journals $10^{\times}$ will gradually rise, and the controller arm 40 will be slowly swung in the direction of arrow 100, its depending arm 41 being swung in the opposite direction and thereby turning the bell-crank on its axis 36 to swing its long arm 33 outward, or to the left, Fig. 2. Such movement operates to gradually move the belt-shifter to the left, and the belt 23 will thereby be gradually shifted from the smaller to the larger end of the driven cone C′, resulting in a gradual diminution in the speed of rotation of said cone and its attached traverse shaft 21. Consequently the traverse speed will be gradually reduced in accordance with the gradual increase in the diameter of the ball, during the winding operation. When the ball is started, with the minimum diameter and the given surface speed, the traverse will be at the maximum speed, for then the traverse shaft will be rotated at the highest speed, but as the rotations of the ball diminish with its increasing diameter the controller will act through the speed-changing mechanism to gradually decrease the speed of the traverse shaft, and consequently of the traverse. As a result the pitch of the winding of yarn laid upon the ball is gradually diminished from the beginning to the end of the winding operation, overcoming any tendency of the yarn to pile up on itself, and each succeeding layer serves to more securely and firmly bind and compact the preceding layers into the general yarn-mass.

When the winding is about to begin the balling-roll 10 will rest directly upon the driving drums D and D′, and then the journals $10^{\times}$ will be at their lowest point in the upright guideways. At such time the lower arm 41 of the controller 40, 41 will be in its extreme left hand position, viewing Fig. 1, with the belt 23 at the proper point on the speed-cones to begin the winding.

The spring 39 operates to keep the arm 40 of the controller in engagement with the adjacent roll-journal 10, and will assist in restoring the controller and the belt-shifting means to starting position, in readiness to begin the winding of a ball.

My invention is not restricted to the precise details of construction and arrangement herein shown and described as the same may be modified or changed in various details by those skilled in the art without departing from the spirit and scope of my invention.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. The combination, in a balling machine, of positively driven drums to support and rotate the ball by surface contact therewith, a traverse-shaft having double or crossing threads, a carriage reciprocated thereby and provided with a guide eye to deliver the chain of yarn to the ball, and means directly actuated solely from the drums to rotate the traverse-shaft and automatically effect a gradual change in the ratio between the traverse speed and the surface speed of the ball throughout the winding operation.

2. The combination, in a balling machine, of positively driven drums to support and rotate the ball by surface contact therewith, a traverse-shaft having double or crossing threads, a carriage reciprocated thereby and provided with a guide-eye to deliver the chain of yarn to the ball, and speed-changing mechanism directly connecting the drums and the traverse-shaft, to vary automatically the speed of rotation of one with relation to the other and thereby effect a gradual change in the ratio between the surface speed of the ball and the traverse speed throughout the winding operation.

3. The combination, in a balling machine, of means rotated at constant speed to effect rotation of the ball by surface contact therewith, means, including a traverse shaft, to lay the yarn chain upon the ball as the latter is rotated, direct connections between the ball-rotating means and the traverse shaft to rotate the latter, said connections including speed-changing-mechanism, and a controller for said mechanism, governed automatically by the ball, to cause said mechanism to diminish the speed of rotation of the traverse shaft as the diameter of the ball increases.

4. In a balling machine, in combination, drums driven at a constant speed, to support and rotate the ball by surface contact therewith, a driving cone connected therewith, a driven cone, a traverse shaft connected therewith and having double or crossing threads, a guide eye for the yarn-chain, reciprocated by said shaft, a belt connecting the cones, and automatic means to gradually shift the belt from the smaller to the larger end of the driven cone as the diameter of the ball increases, to thereby reduce the speed of the traverse shaft as the winding progresses.

5. The combination, in a balling machine, of positively driven drums to support and rotate the ball by surface contact therewith, a traverse-shaft having double or crossing threads, a carriage reciprocated thereby and provided with a guide-eye to deliver the chain of yarn to the ball, connections between the drums and the traverse-shaft, including speed-cones and a belt connecting them, a belt-shifter, and means governed by the diameter of the ball to operate said belt-shifter and gradually decrease the speed of the traverse shaft as the diameter of the ball increases.

6. In a balling machine, a positively driven drum to rotate the ball by surface contact, means to traverse the yarn upon the drum, said means including a traverse shaft, reversed cones rigidly connected with the drum and the traverse shaft, a belt connecting them, to drive the shaft cone from the drum cone, and means to automatically shift the belt from the smaller to the larger end of the shaft cone as the ball increases in diameter, to thereby cause the yarn to be laid upon the ball with a gradually decreasing pitch throughout the winding operation.

7. The combination, in a balling machine, of a roll on which the chain of yarn is wound to form a ball, means to rotate the ball by surface contact therewith, means actuated independently of the ball to traverse the yarn-chain and lay it upon the ball, speed-changing mechanism to actuate the traverse means, said mechanism directly connecting the ball rotating and the traverse means, and a controller for said mechanism, operated by the change in the position of the roll as the diameter of the ball thereon increases.

8. The combination, in a balling machine, of driving drums rotated at constant speed, a roll on which the ball is wound, driven by surface contact with the drums, upright guides for the journals of the roll, means, including a traverse shaft having a double or crossing thread, to lay the chain of yarn upon the ball, opposed cones operatively connected with the driving drums, a transmitting belt between the cones, and a belt-shifter having a member in engagement with and positioned by the roll as the ball thereon increases in diameter, to gradually shift the belt from the smaller to the larger end of the traverse shaft cone and thereby decrease the speed of the traverse means as the winding progresses.

9. The combination, in a balling machine, of means to support and rotate the ball at a constant surface speed, means to traverse the chain of yarn and lay the same upon the rotating ball, and an instrumentality to effect automatically a gradual diminution in the speed of the traverse means as the diameter of the ball increases.

10. The combination, in a balling machine, of means to rotate the ball, means actuated independently of the ball to traverse the chain of yarn and lay the same upon the ball as the latter rotates, and an instrumentality to effect automatically a gradual change in the ratio between the traverse speed and the surface speed of the ball as the winding progresses.

11. The combination, in a balling machine, of means operating at a constant speed to rotate the ball, means actuated independently of the ball to traverse the chain of yarn and lay the same upon the ball as the latter rotates, and an instrumentality governed by or through the increase in the diameter of the ball to effect automatically a gradual change in the ratio between the traverse speed and the surface speed of the ball as the diameter of the latter increases.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ALONZO E. RHOADES.

Witnesses:
Clare Hill Draper,
Eugene Beaudry.

J. O. McKEAN.

WINDING MACHINE.

APPLICATION FILED APR. 16, 1908.

952,015. Patented Mar. 15, 1910.

4 SHEETS—SHEET 1.

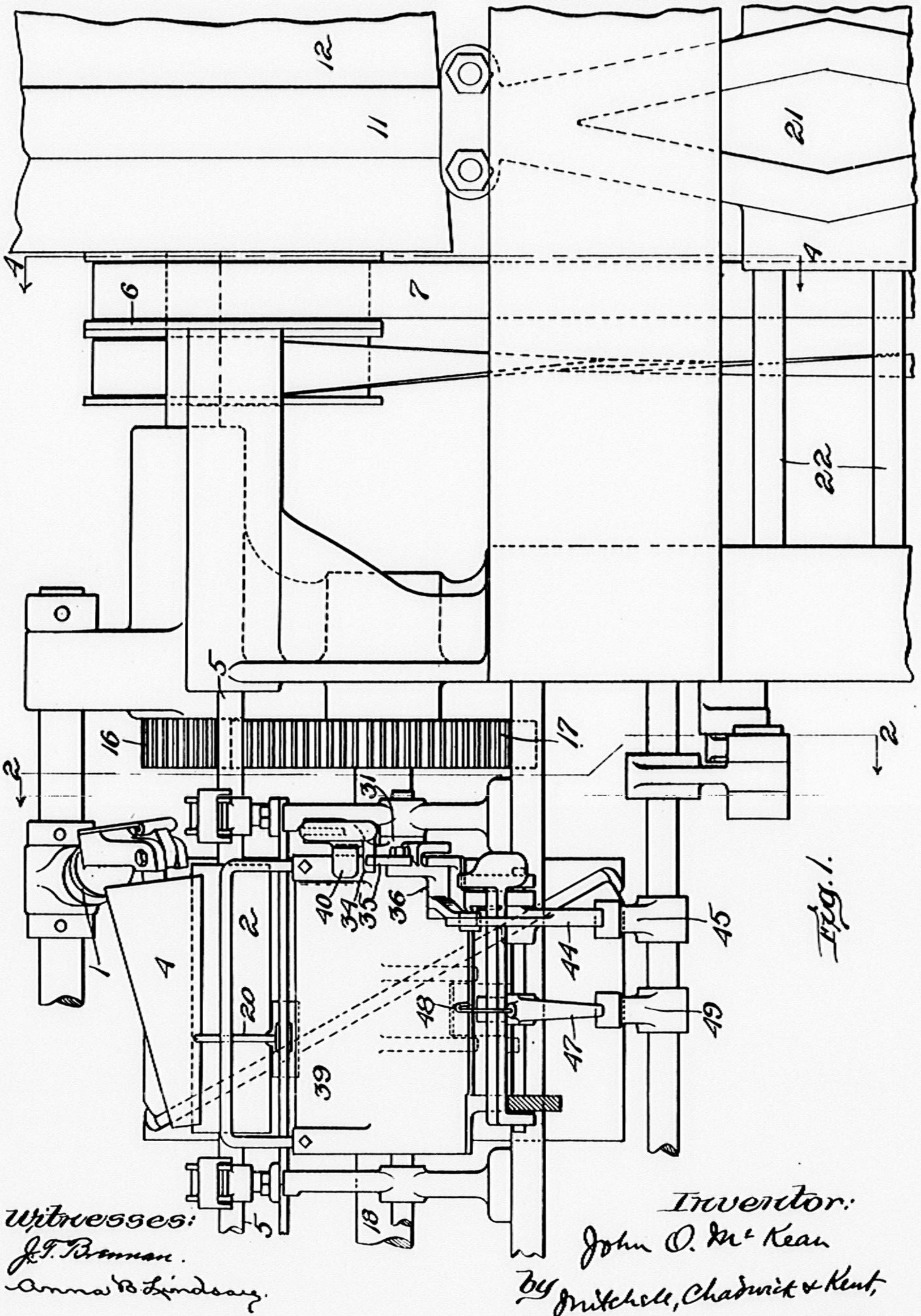

Fig. 1.

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WINDING MACHINE.
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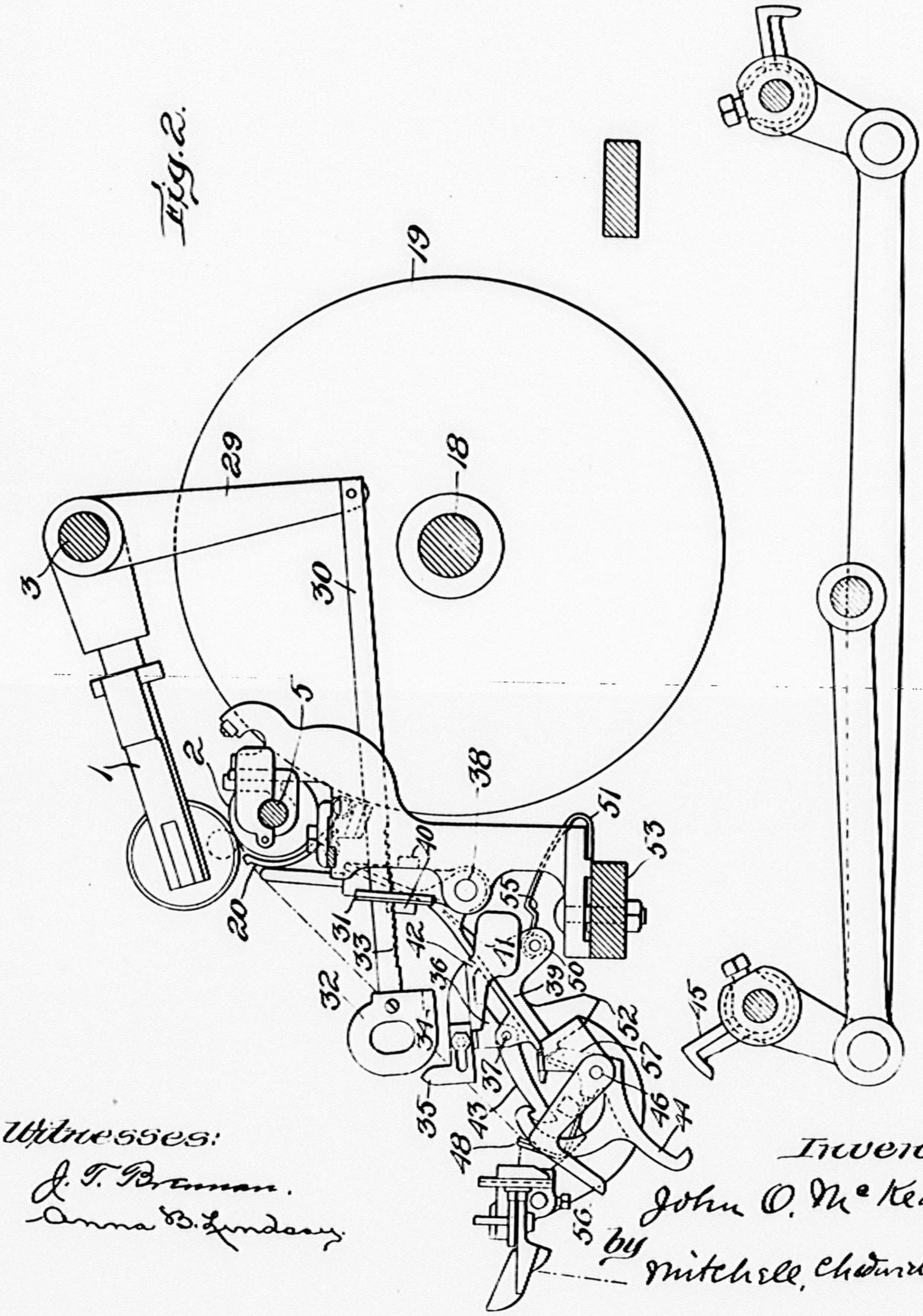
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

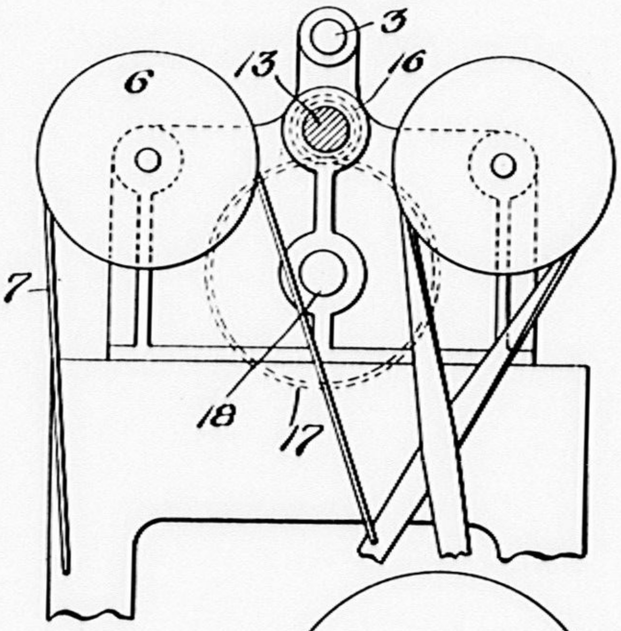

Fig. 4.

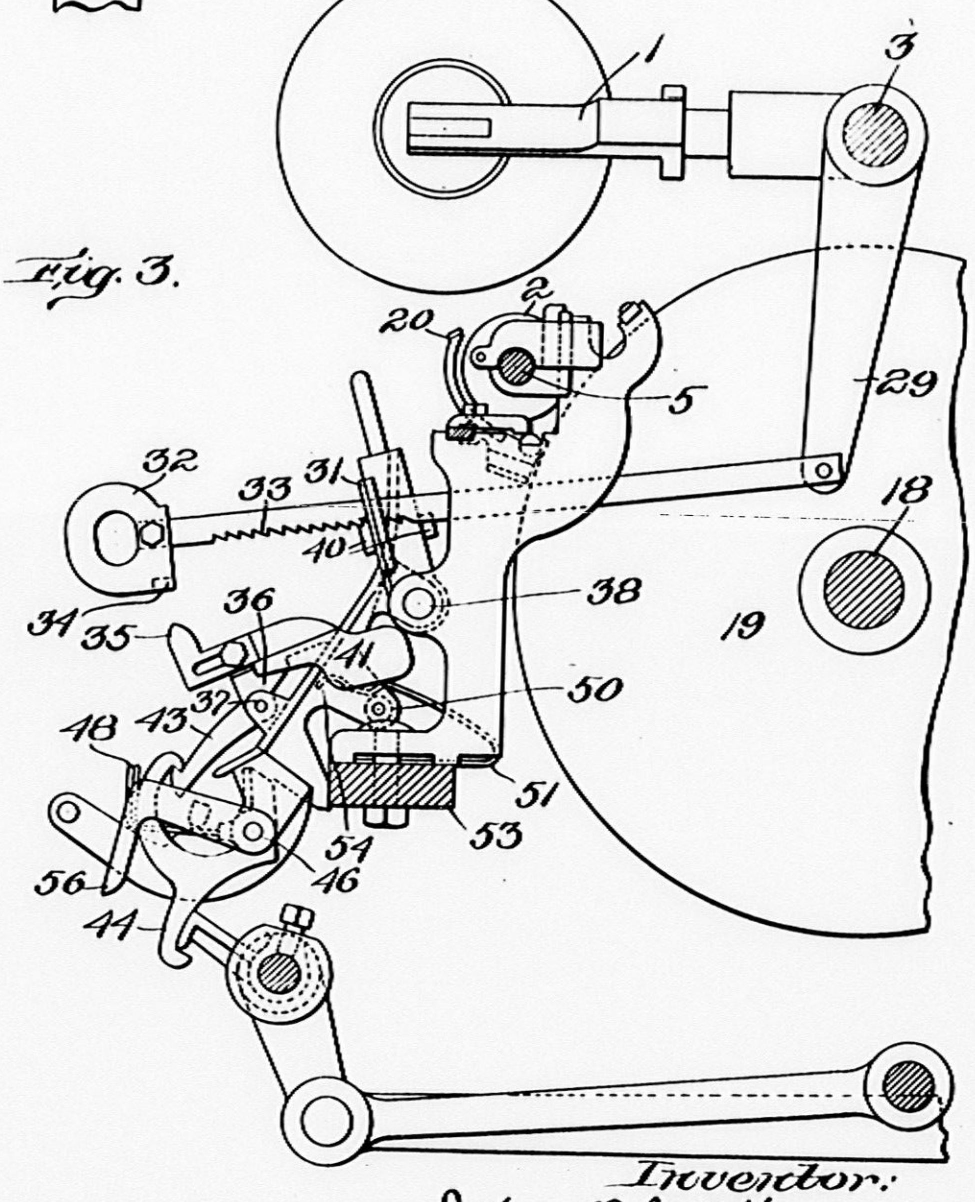

Fig. 3.

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WINDING MACHINE.

APPLICATION FILED APR. 16, 1908.

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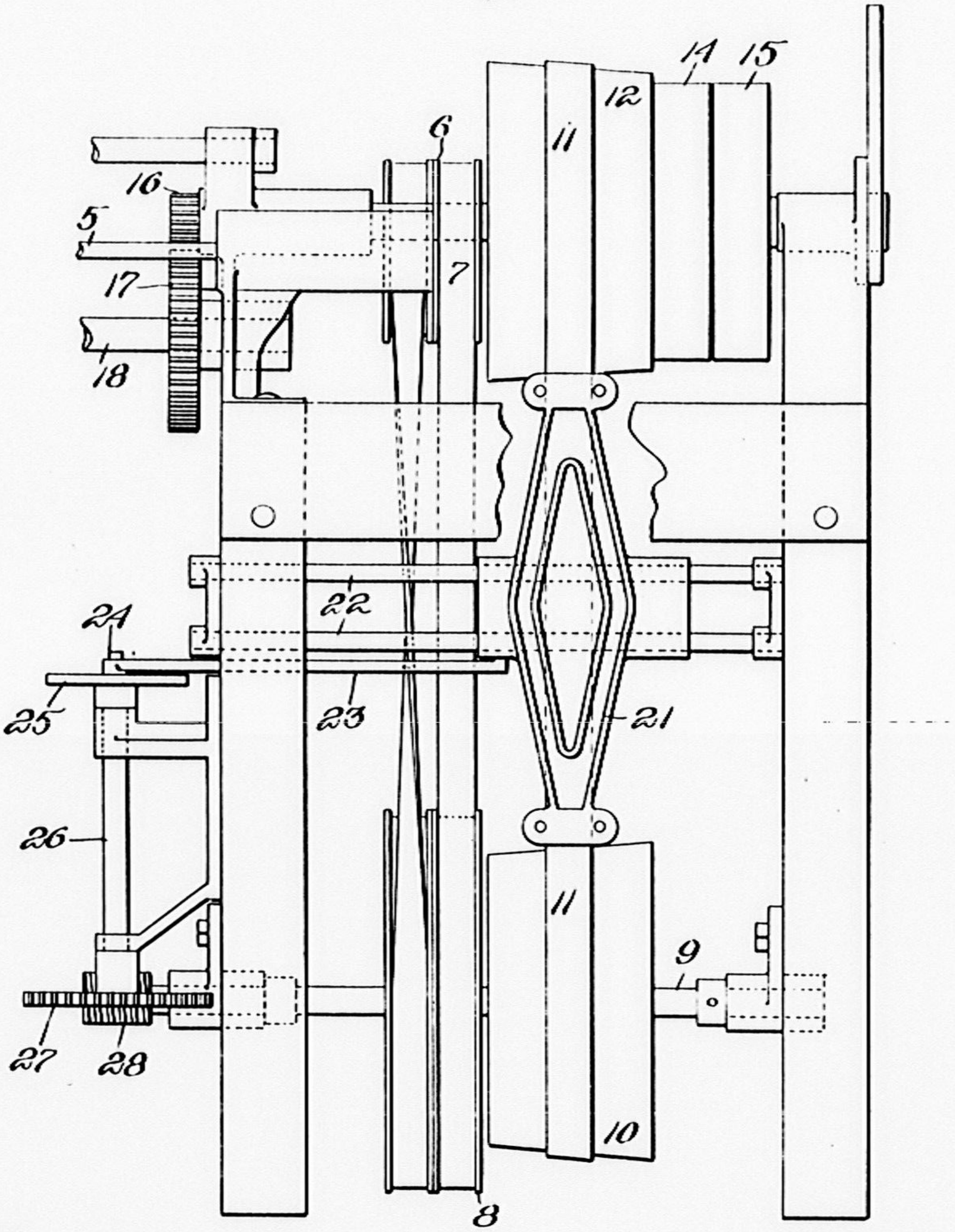
4 SHEETS—SHEET 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN O. McKEAN, OF WESTFIELD, MASSACHUSETTS, ASSIGNOR TO FOSTER MACHINE COMPANY, OF WESTFIELD, MASSACHUSETTS, A CORPORATION OF MAINE.

WINDING-MACHINE.

952,015. Specification of Letters Patent. **Patented Mar. 15, 1910.**

Application filed April 16, 1908. Serial No. 427,327.

To all whom it may concern:

Be it known that I, JOHN O. MCKEAN, a citizen of the United States, and resident of Westfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Winding-Machines, of which the following is a specification.

My invention relates to winding machines and particularly to that class of winding machines wherein the cop being formed is surface driven frictionally by a constantly rotating cop-driving roll.

The object of my invention is to improve the construction of machines of this class so as to wind cops of a pre-determined size, and also to improve such machines with respect to the stop motion whereby the winding is stopped when a thread breaks, and with respect to the automatic control for the driving roll whereby the speed of the latter with relation to the speed of the thread guide is varied to control the laying of the thread or threads on to the cop.

A feature of my invention consists in providing automatic means to shift the cop out of contact with its driving roll to stop the winding when the cop has been wound to a pre-determined size.

Another feature of my invention consists in having this automatic size controlling means controlled also by the thread which is being wound so that when the latter breaks said size controlling means is automatically operated so as to shift the cop out of contact with its driving roll and stop the winding operation.

A third feature of my invention resides in the improved means hereinafter described for varying the relative speeds of the reciprocating thread guide and the driving roll for the purposes fully set forth in my Patent No. 716,923 dated December 30, 1902.

Other features of my invention are hereinafter pointed out.

In the accompanying drawings:—Figure 1 is a partial front elevation of a winding machine embodying one form of my invention; Fig. 2 is a section on line 2—2 of Fig. 1; Fig. 3 shows the left hand side of Fig. 2 with the parts in another position; Fig. 4 is a section on line 4—4 of Fig. 1; Fig. 5 shows in side elevation the drive end of the machine shown in Fig. 1.

Having reference to the drawings, 1 represents the holder for the cop shell and 2 the cop driving roll. The holder 1 is of ordinary construction and is as usual pivoted loosely on a rod 3 supported at its ends by the frame of the machine. The shell 4 onto which the thread is to be wound is supported by holder 1 so as to be free to rotate and is pressed against the drive roll 2 by the weight of holder 1. The drive roll 2 is fixed to a shaft 5 journaled on the frame of the machine and carrying at one end a pulley 6 connected by a belt 7 with a pulley 8 fast to a counter shaft 9. Shaft 9 also carries a cone pulley 10 connected by belt 11 with an opposed cone pulley 12, fast on the main drive shaft 13 of the machine. On shaft 13 is a tight pulley 14 through which said shaft is driven, and a loose pulley 15. At its inner end shaft 13 also carries a pinion 16 driving a gear 17 fast to the cam shaft 18. Shaft 18, as usual, carries a cam 19 for each section of the machine which reciprocates the usual thread guide 20.

The belt 11 through which the drive rolls 2 are driven from main shaft 13, is engaged by a shipper 21 mounted to slide on two rods 22 fixed to the frame. Shipper 21 is connected by a link 23 with a crank or wrist pin 24 carried by a disk 25 fixed to the upper end of a shaft 26. Shaft 26 at its lower end carries a worm gear 27 that is driven by a worm 28 fast to the counter shaft 9. It will now be clear that while shaft 13 acts through pinion 16 and gear 17 to drive cam shaft 18 continuously at a uniform rate of speed, it also acts through belt 11, shaft 9, and belt 7 to drive shaft 5 that carries the drive roll 2, but the rotation of wrist pin 24 acts through link 23 to shift belt shipper 21 back and forth on rods 22 thereby shifting belt 11 back and forth on cone pulleys 10 and 12 so that the speed of shaft 5 is varied it being alternately accelerated and retarded as belt 11 is thus shifted back and forth. It will be noted that wrist pin 24 is driven from shaft 9 and therefore its speed of rotation varies with that of shaft 9 so that belt 11 is held at the larger end of pulley 10 for a longer time and at the smaller end of said pulley for a shorter time than would be the case if shipper 21 were shifted back and forth at a uniform rate of speed. Consequently a greater variation in the "pitch" and number of the windings on the cop is secured than would be the case if a uniform motion were imparted to shipper 21.

The cop holder 1 is provided with a rigid arm 29 to the lower end of which is pivotally connected the inner end of a bar 30 that extends through a slotted arm 31 and carries at its outer end a handle 32. Upon the under side of bar 30 is a rack of ratchet teeth 33 to engage the arm 31 when the latter is moved in one direction only, said teeth slipping idly past said arm when said arm is moved in the opposite direction or when said bar is moved outwardly. Projecting from the side of handle 32 is a lug 34 coöperating with a bracket 35 adjustably clamped to a latch 36 pivoted at 37 to a lever frame 39. The lever frame 39 is fulcrumed at 38 to the frame of the machine and is embraced at one side by a pair of lugs 40 projecting from the arm 31 which is mounted on the same fulcrum rod 38 as said lever frame 39, so that the two, lever frame 39 and arm 31 are thus locked together and swing on rod 38 as one. The latch lever 36 carries at one side of its pivot 37, a weight 41 that holds the latch lever 36 in its normal position with a stop 42 on said lever 36 resting against lever frame 39, and with a latch arm 43 provided on lever 36 at the other side of pivot 37, in position to engage the upper arm of a drop hook 44 so as to hold the lower arms of said hook out of the path of a continuously vibrating arm 45. The drop hook 44 is fixed to rock shaft 46 journaled on the lever frame 39. This rock shaft 46 has loosely mounted on it a second drop hook 47 provided with an arm 48 that normally is engaged and supported by the thread as shown in Fig. 2 so that the lower arm thereof is held out of the path of a continuously vibrating arm 49. It is to be noted that the two hooks 44 and 47 although mounted on the same shaft 46 are independently movable, one being normally supported by the latch arm 43 and the other by the thread. Upon its under side the lever frame 39 carries a roller 50 and a spring latch 51, fast to the frame of the machine, engages this roll and holds the lever frame 39 in its normal position shown in Fig. 2. When however, the thread breaks and drops hook 47 or latch lever 36 is operated to drop hook 44, then arm 45 or 49, of the hook that is dropped, engages and pulls down on said hook thus swinging lever frame 39 on fulcrum 38 and causing arm 31 which is always in engagement with teeth 33 to pull bar 30 outwardly thereby lifting the cop out of contact with the drive roll 2 as shown in Fig. 3. The lever frame 39 is provided on its under side with a stop lug 52 to engage the longitudinal bar 53 of the frame of the machine and limit the swinging movement of lever frame 39 in one direction. When lever frame 39 is pulled down as just described the roll 50 passes from a hook 54, (Fig. 3) to a hook 55, both formed in the spring latch 51, the hook 54 serving to yieldingly hold the lever frame in the position shown in Fig. 2 and the hook 55 serving to yieldingly hold said frame in the position shown in Fig. 3.

The rock shaft 46 has fixed to it a handle 56 to be grasped and lifted upon by the operator to restore the parts to normal position. If the parts have been shifted into the position shown in Fig. 3 through the dropping of hook 44 then an upward pull upon this handle 56 acts first to rock shaft 46, thereby swinging hook 44 out of the path of arm 45 until a stop arm 57 on said hook engages lever frame 39, at which time the upper arm of hook 44 reëngages latch lever 36. Thereafter lever frame 39 swings on fulcrum 38 until stopped by roll 50 engaging hook 54 of latch 51. If the parts have been shifted into the position shown in Fig. 3 through the dropping of hook 47, then an upward pull upon handle 56 immediately lifts lever frame 39, the hook 47 being moved and held out of the path of arm 49 by hand as the handle 56 is lifted. The reëngagement of arm 48 with the thread holds hook 47 in normal position.

When the winding is started the bar 30 occupies its innermost position and as the cop grows in diameter during the operation of winding the arm 29 shifts the bar 30 outwardly, the teeth 33 sliding idly through arm 31. The bracket 35 is fixed to latch lever 36 so that when the cop reaches the desired size the lug 34 by striking bracket 35 moves latch lever 36 in opposition to weight 41 and frees hook 44 which thereupon drops into the path of arm 45 and, as above described the cop holder 1 is lifted and the winding stopped.

The handle 32 is provided so that at any time bar 30 may be pulled out by hand to lift the cop holder 1 and stop the winding operation, the slot in arm 31 being made high enough to permit of lifting lug 34 over bracket 35 so as to avoid dropping hook 44.

The means for stopping the winding operation when the cop reaches a pre-determined size is simple and efficient; and may be adjusted to provide for cops of any desired size within the limits of its capacity. Moreover by the simple addition of the hook 47 the mechanism is adapted to automatically stop the winding operation when a thread breaks.

What I claim is:—

1. In a winding machine, in combination, a cop driving roll; a cop holder movable toward and from said roll; a positively, power operated, constantly moving actuator for shifting the cop holder into inoperative position; and automatic means controlled by the cop holder to connect the cop

holder and the constantly moving actuator when the cop has reached a predetermined size.

2. In a winding machine, in combination, a cop driving roll; a cop holder; a lever connected to the cop holder; a positively, power operated, constantly moving actuator; linkage connected to the lever and normally held out or the path of the constantly moving actuator; and automatic means, controlled by the cop holder, to place the linkage in the path of the constantly moving actuator when the cop reaches a pre-determined size, to cause the constantly moving actuator to shift the cop holder.

3. In a winding machine, in combination, a cop driving roll; a cop holder movable toward and from said roll; a bar connected with the cop holder; a cop holder actuating lever connected with the bar with provision for adjustment of said bar with the cop holder as the latter is shifted by the growth of the cop; a latch carried by the lever and controlled by the bar; a pair of drop hooks carried by said lever and normally held in inoperative position, one by the thread being wound and the other by the latch, and means for engaging either hook when dropped by the latch or thread to operate the lever and shift the cop holder away from the drive roll.

Signed by me at Boston, Suffolk county, Massachusetts, this eleventh day of April 1908.

JOHN O. McKEAN.

Witnesses:
Agnes A. Colgan,
Anna B. Lindsay.

Jan. 29, 1929. 1,700,425

E. J. ABBOTT ET AL

AUTOMATIC WINDING MACHINE
Filed Dec. 7, 1926

14 Sheets-Sheet 1

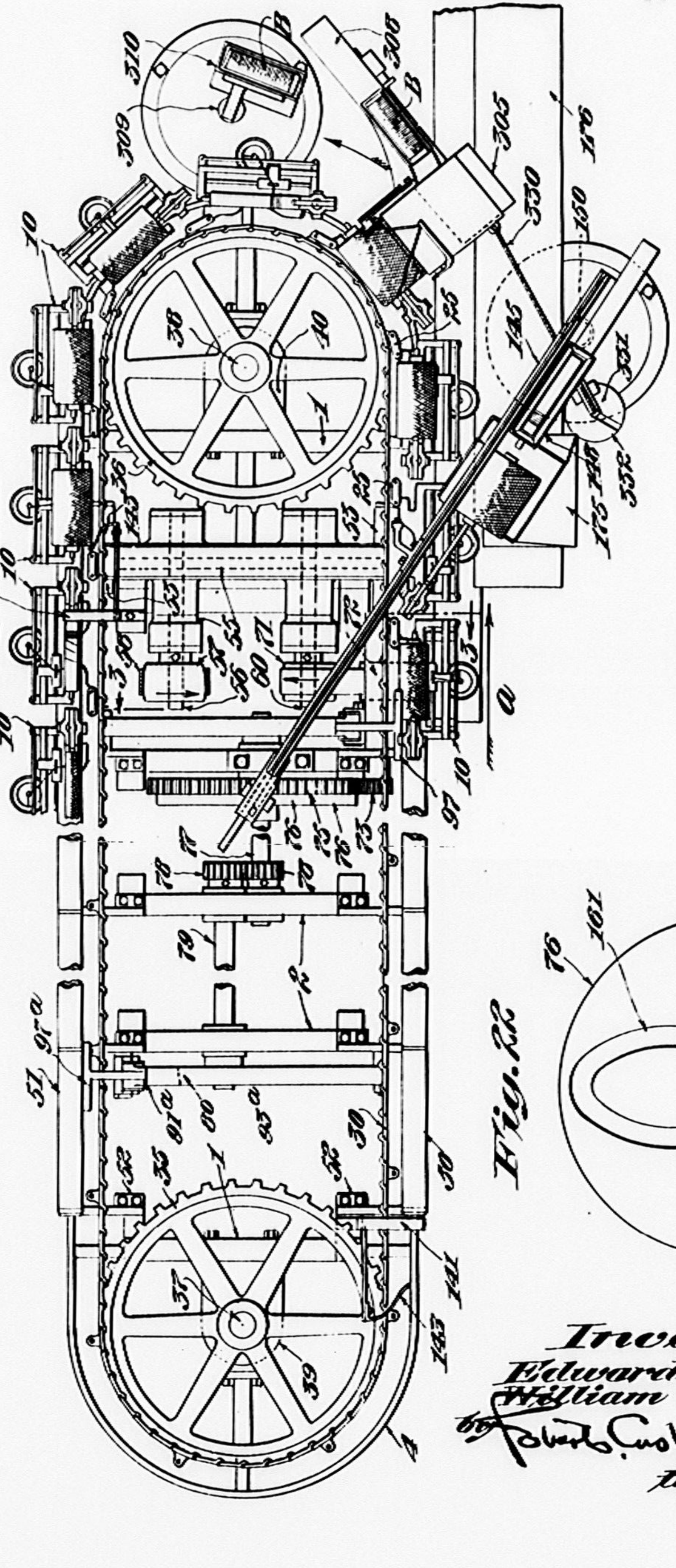


Fig.1

Fig.1a

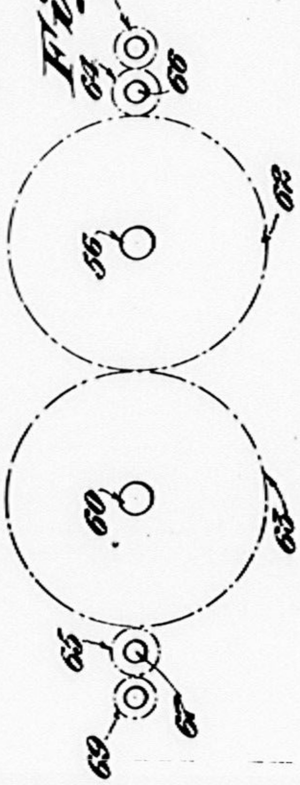
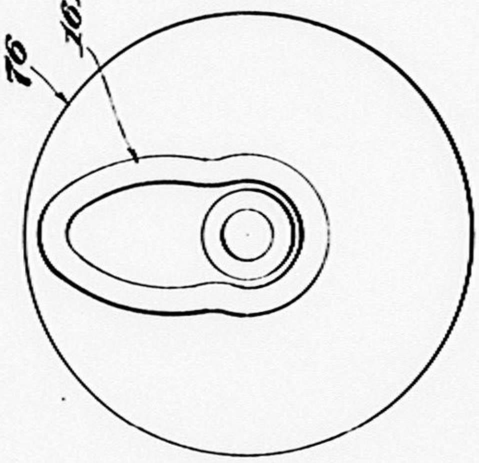


Fig.22



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AUTOMATIC WINDING MACHINE
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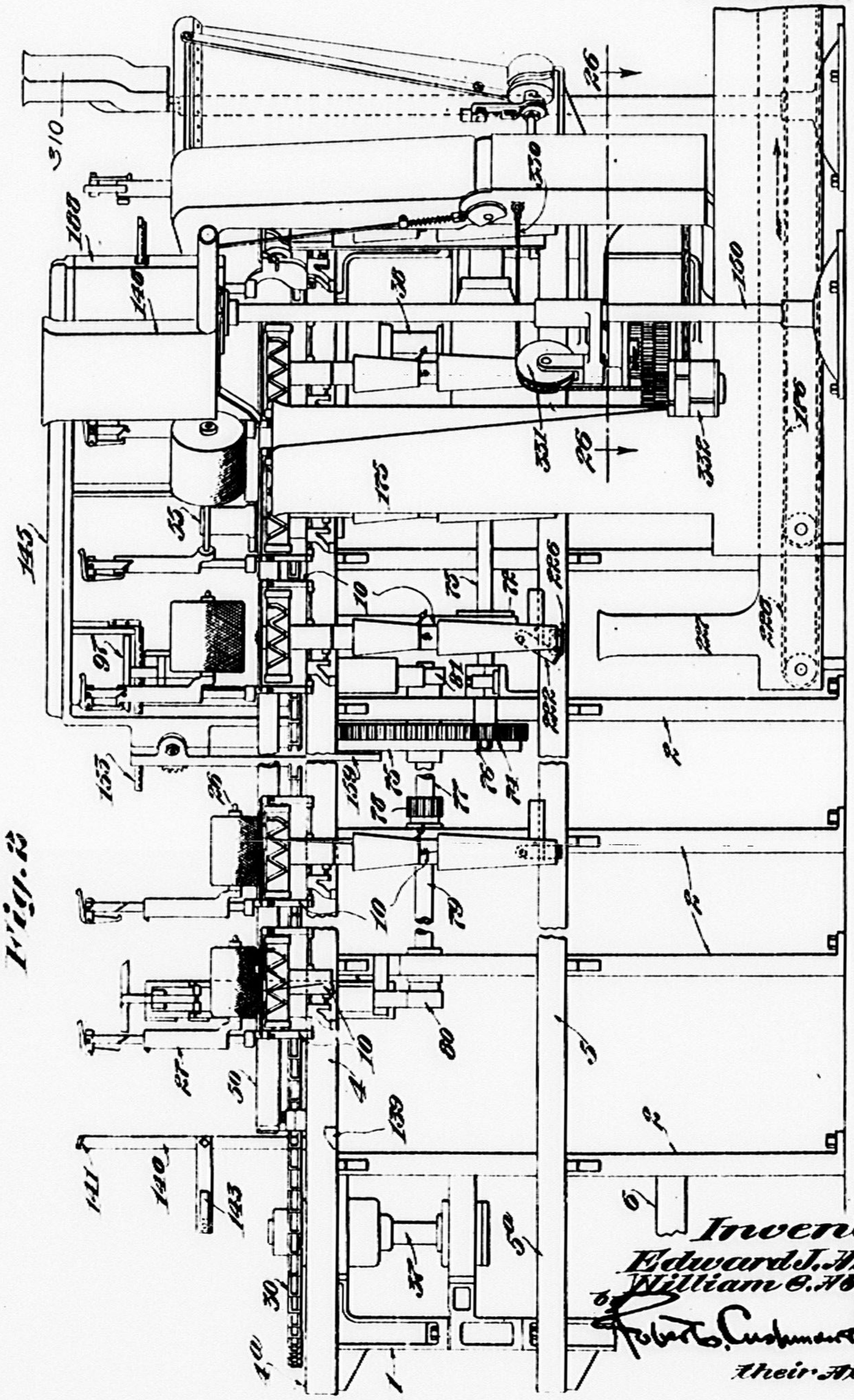
14 Sheets-Sheet 2

Fig. 2



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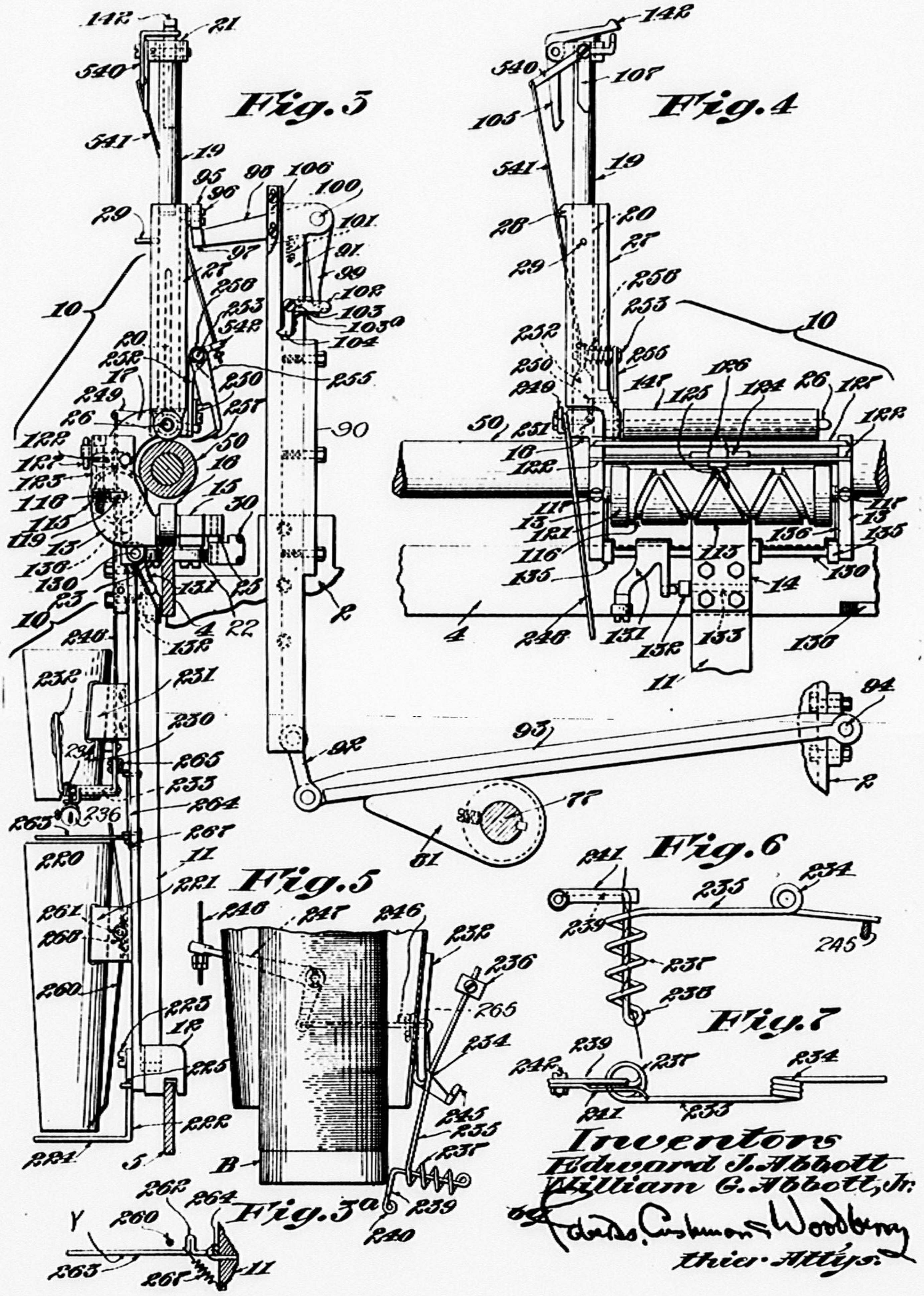
14 Sheets-Sheet 3



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E. J. ABBOTT ET AL

AUTOMATIC WINDING MACHINE
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Fig. 8

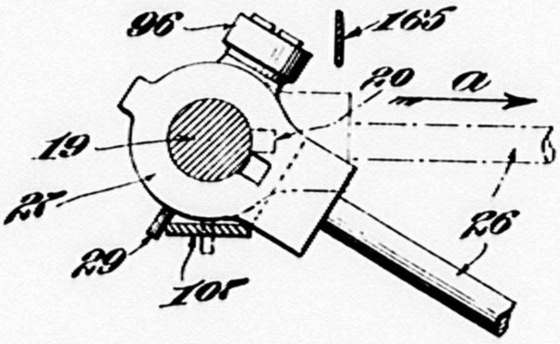


Fig. 9

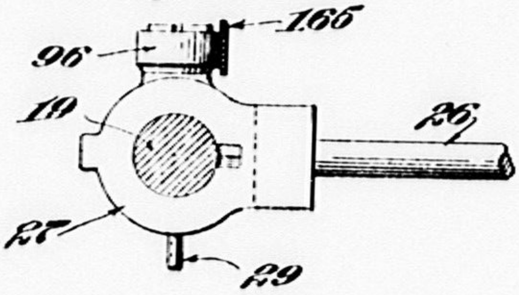


Fig. 11

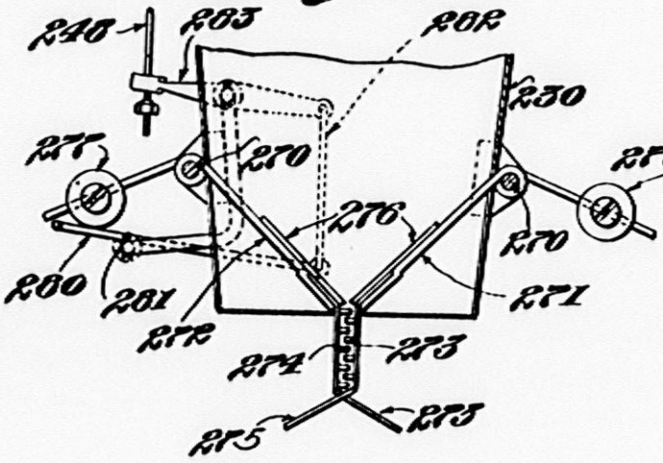


Fig. 10

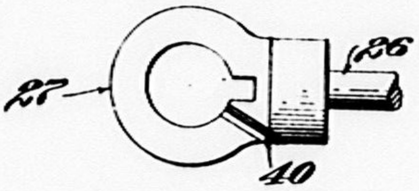


Fig. 14

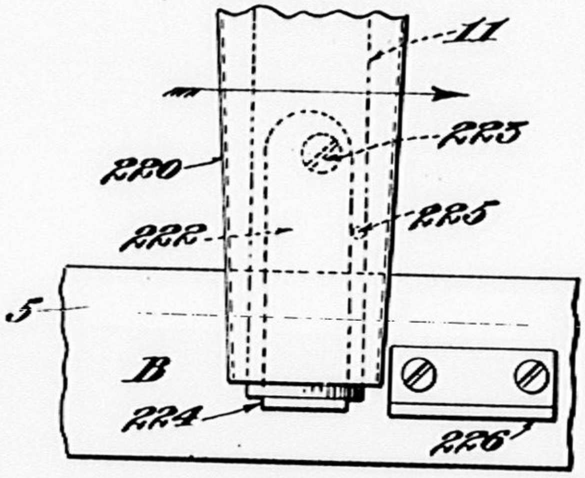


Fig. 12

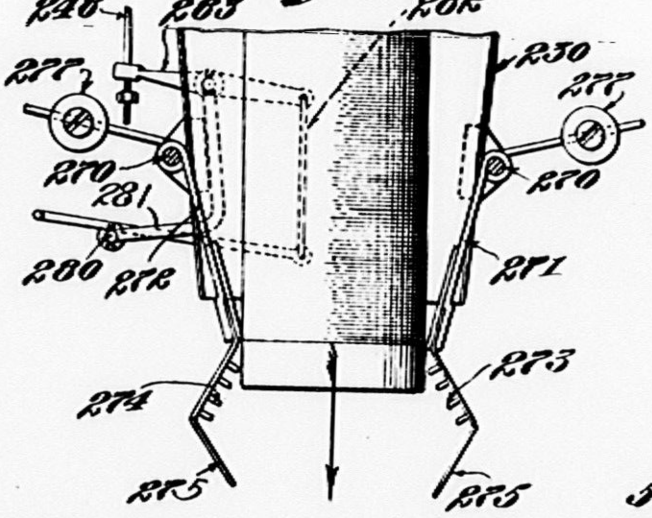


Fig. 15

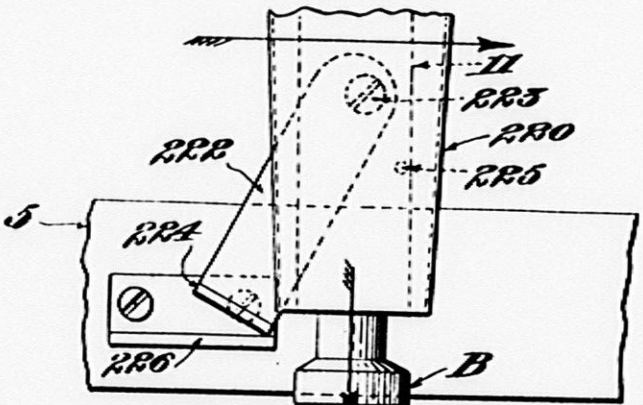
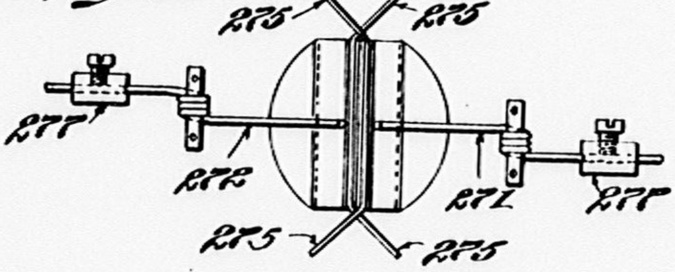


Fig. 13



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E. J. ABBOTT ET AL

AUTOMATIC WINDING MACHINE

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Fig.16

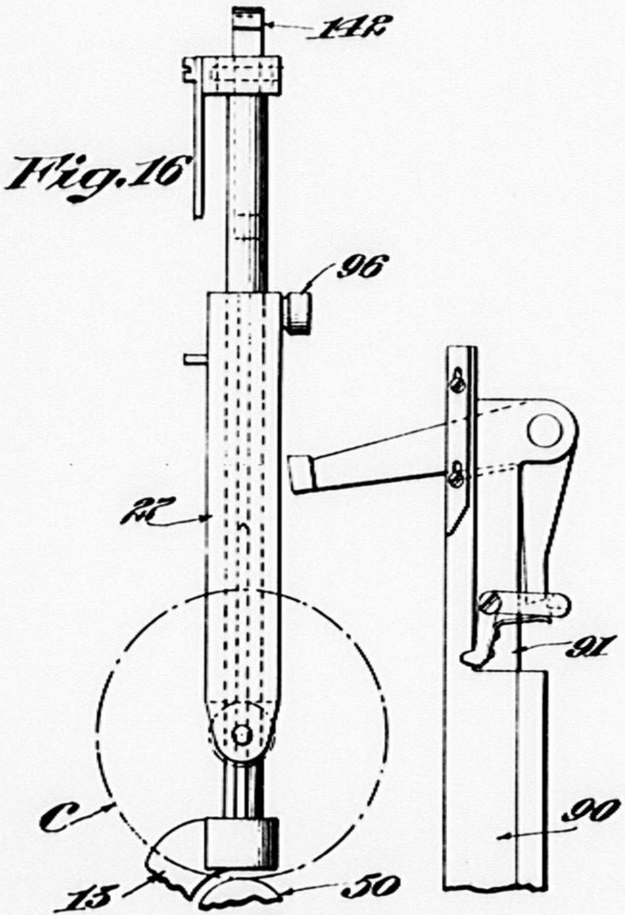


Fig.17

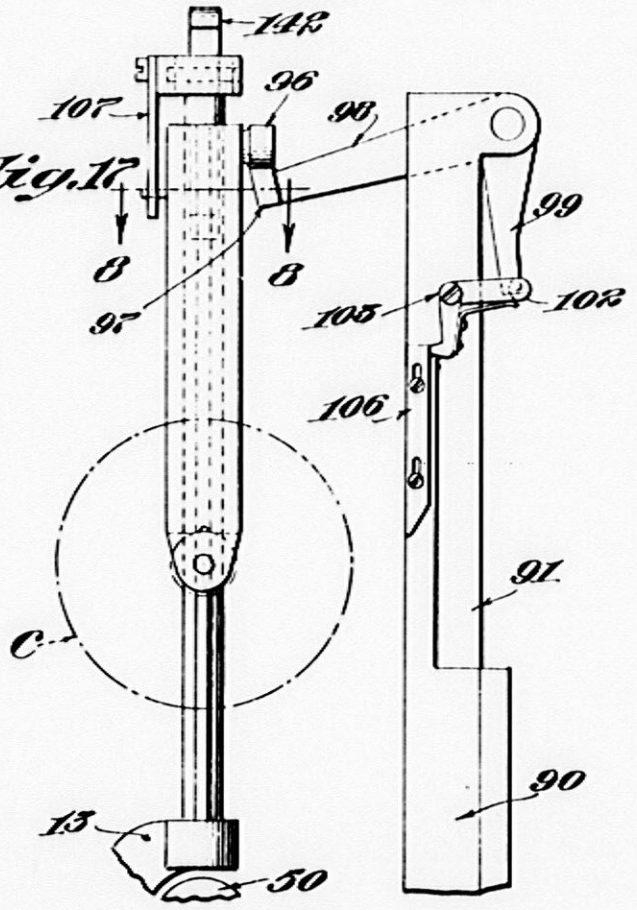


Fig.18

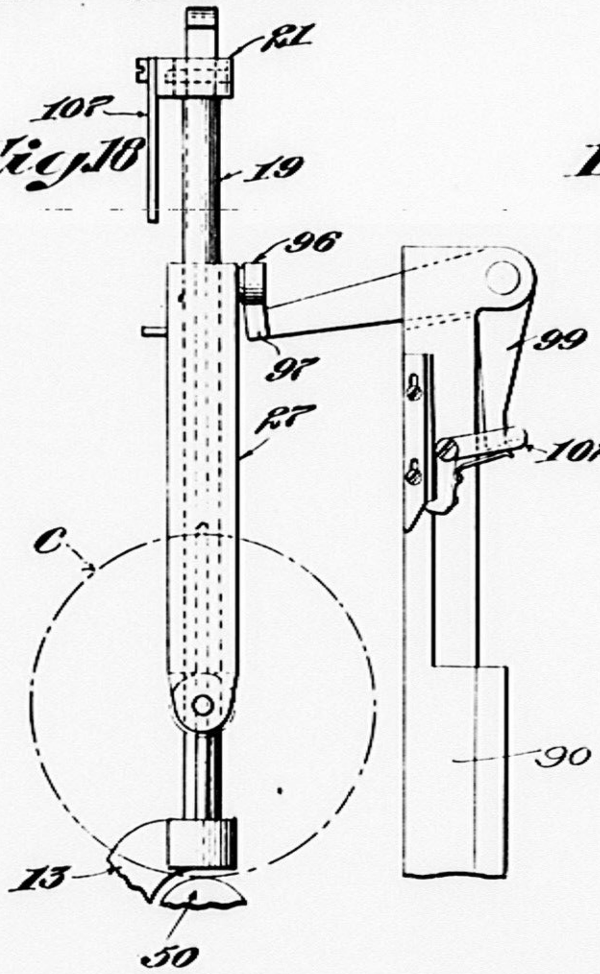
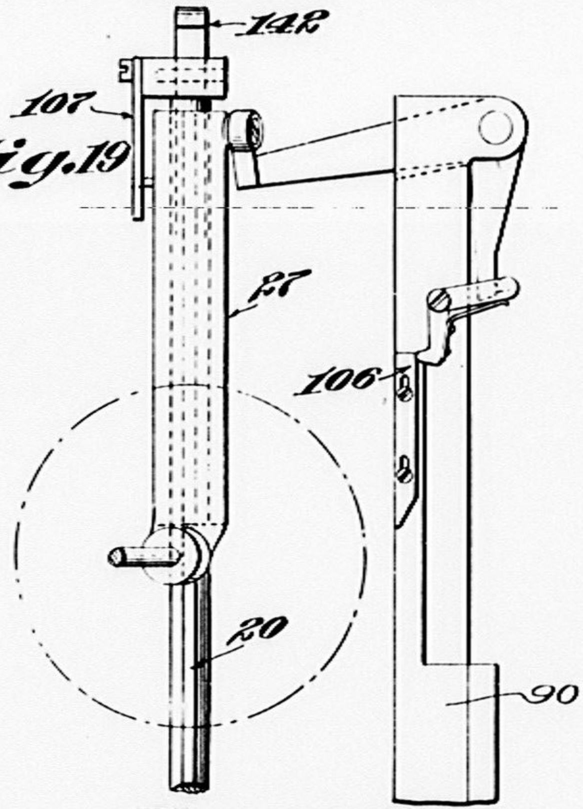


Fig.19



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E. J. ABBOTT ET AL

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14 Sheets-Sheet 6

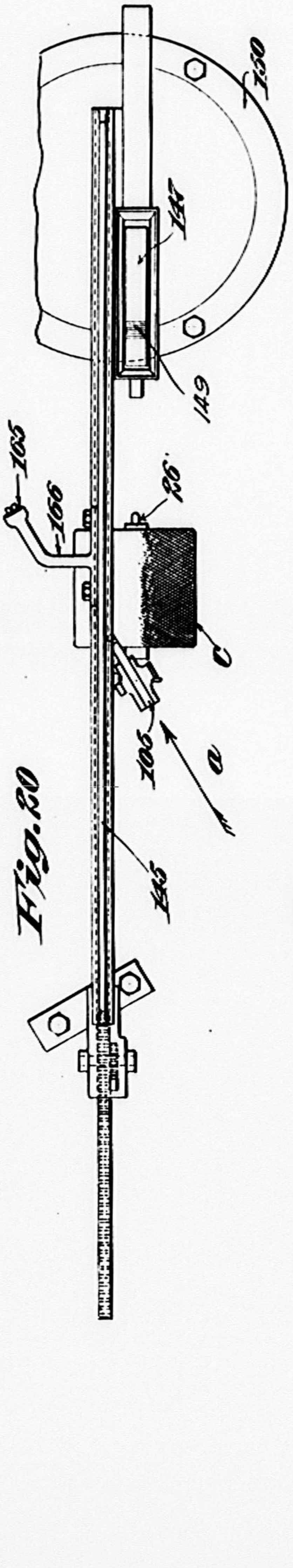

Fig. 20

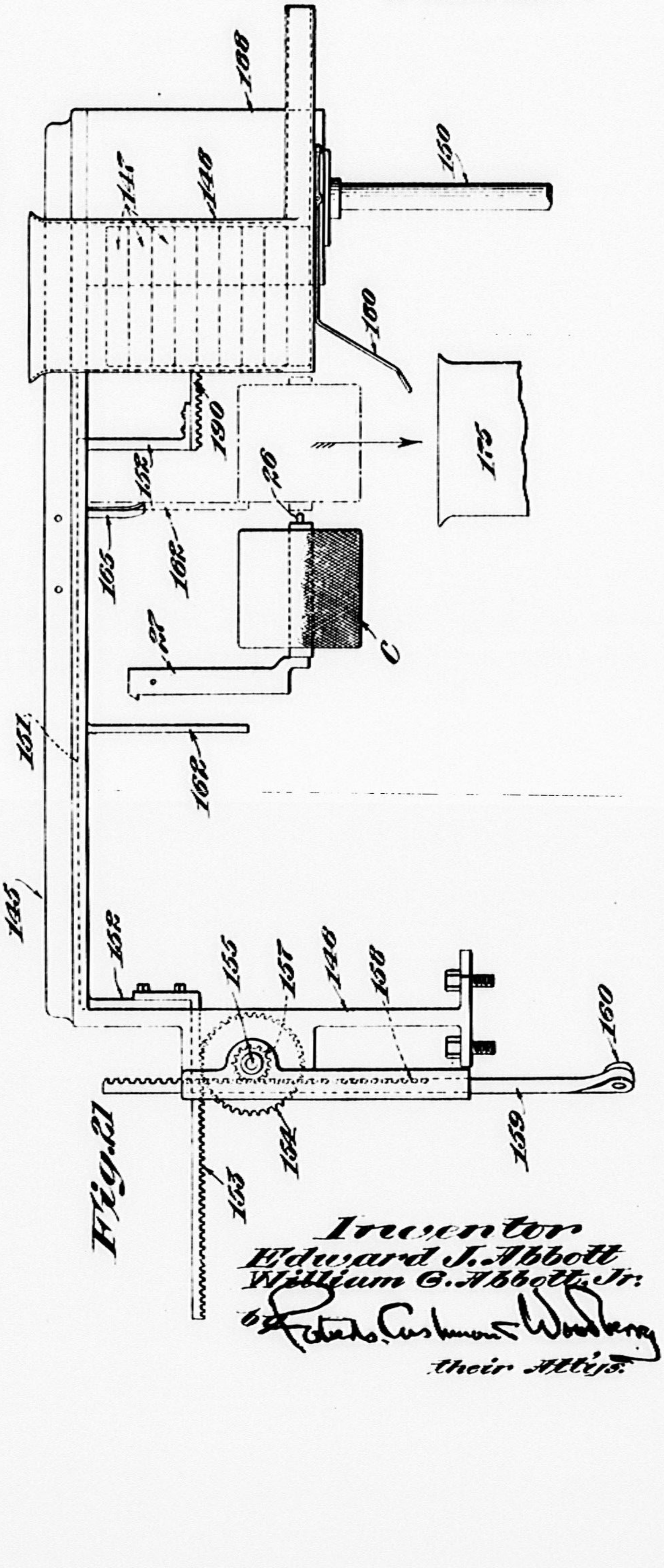

Fig. 21

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AUTOMATIC WINDING MACHINE
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Fig. 23

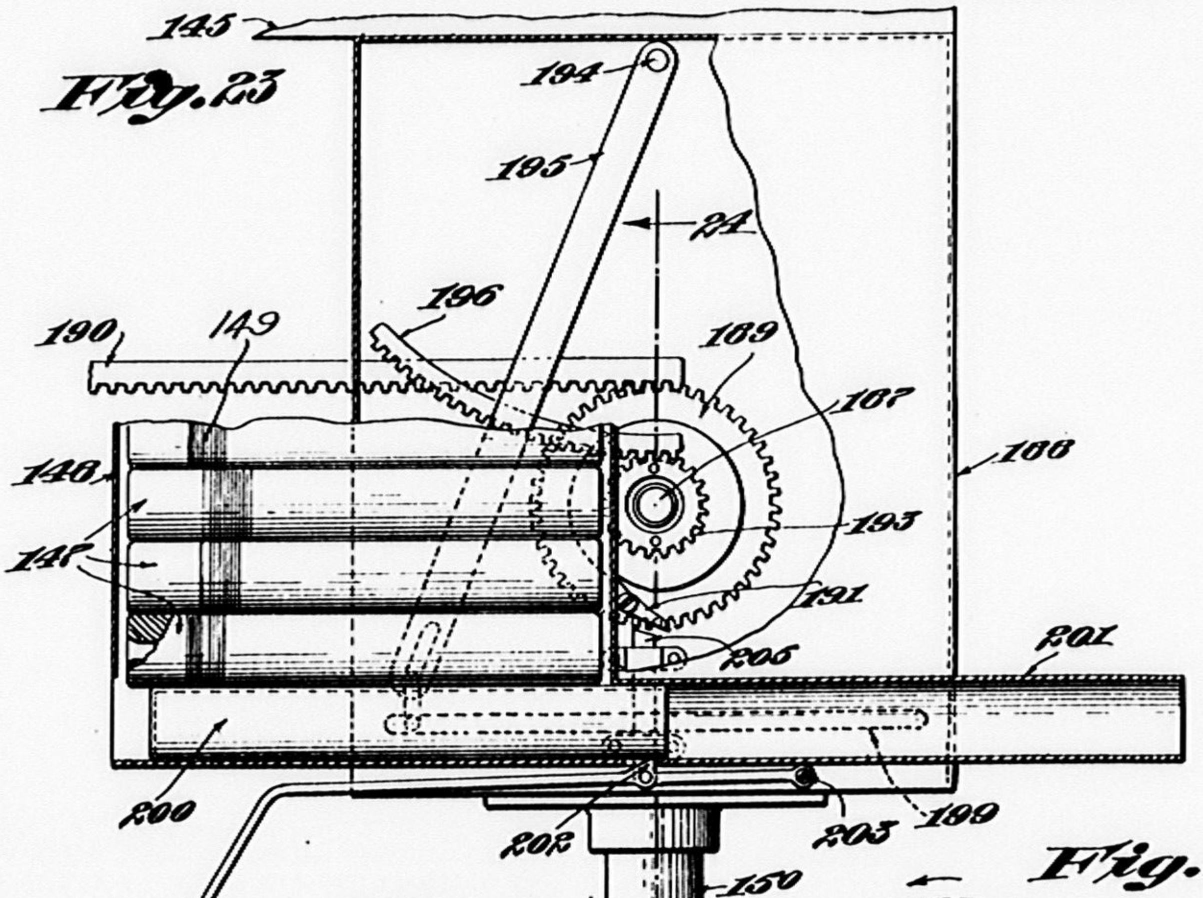


Fig. 24

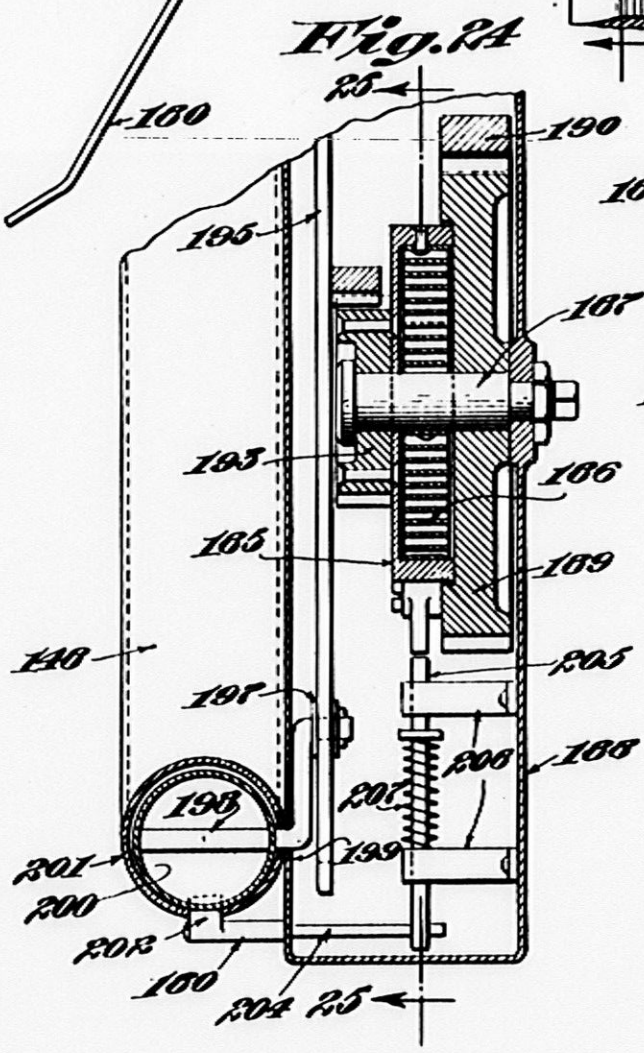
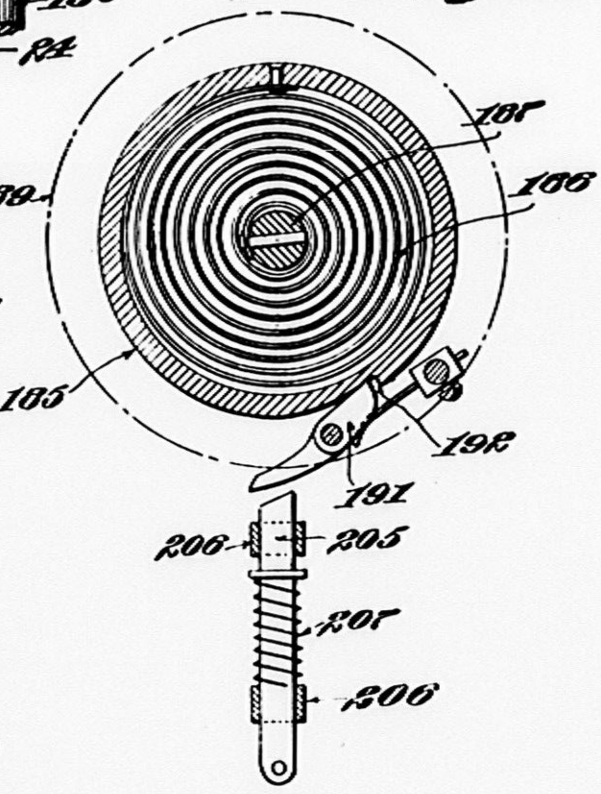


Fig. 25



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Jan. 29, 1929. E. J. ABBOTT ET AL 1,700,425

AUTOMATIC WINDING MACHINE

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Fig. 26

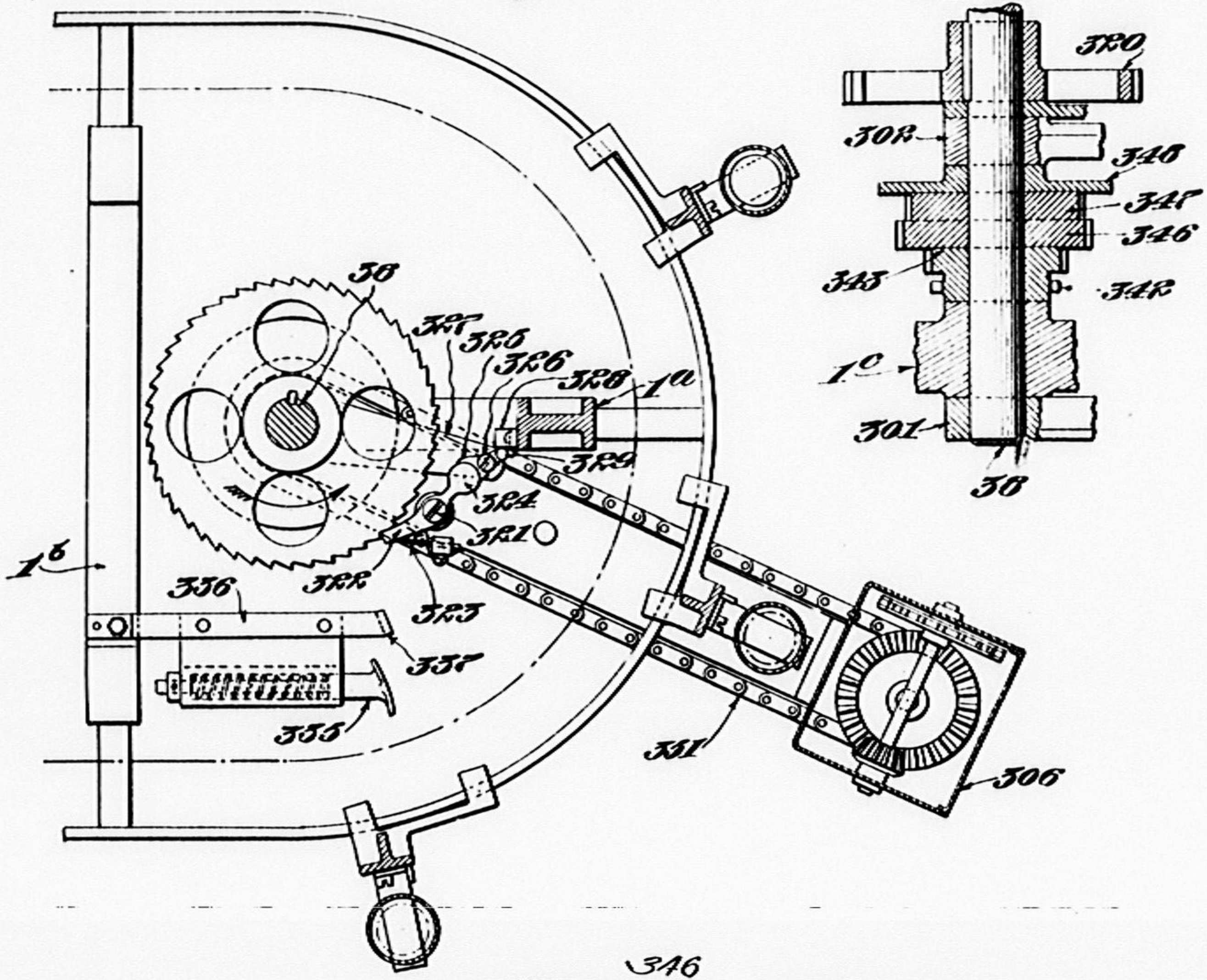
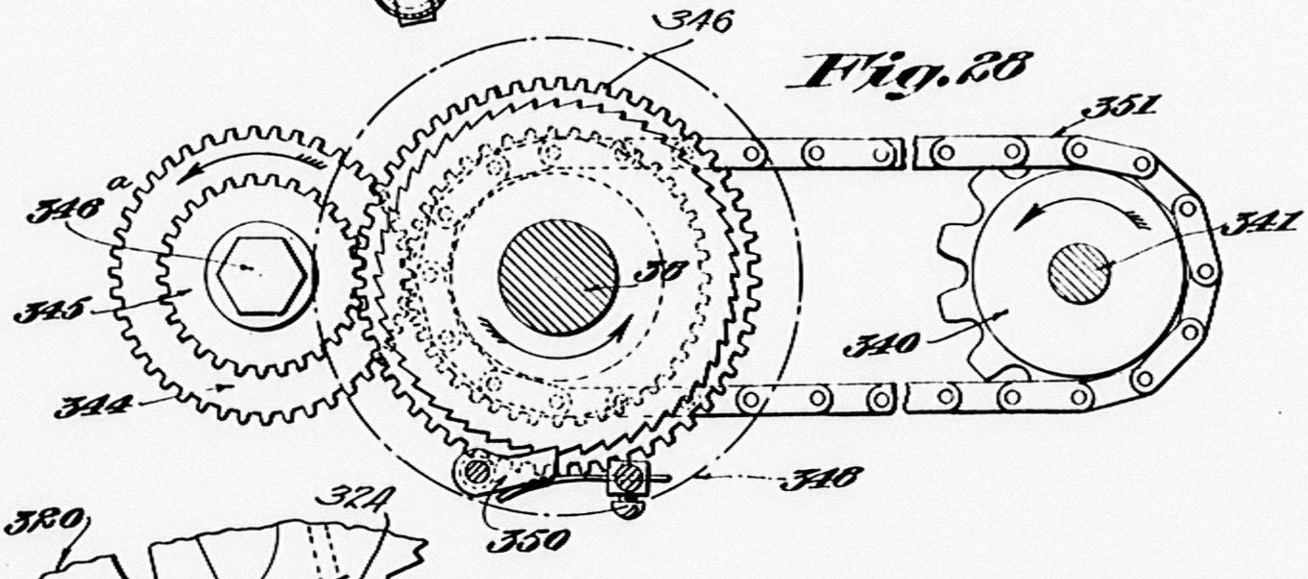


Fig. 27

Fig. 28



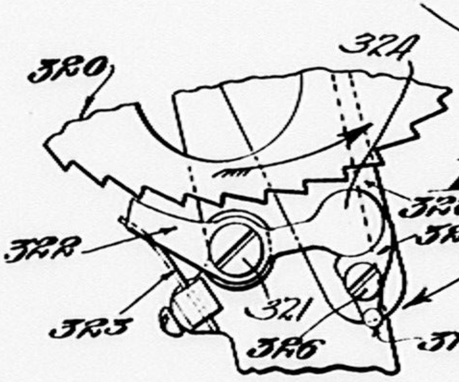


Fig. 29

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AUTOMATIC WINDING MACHINE

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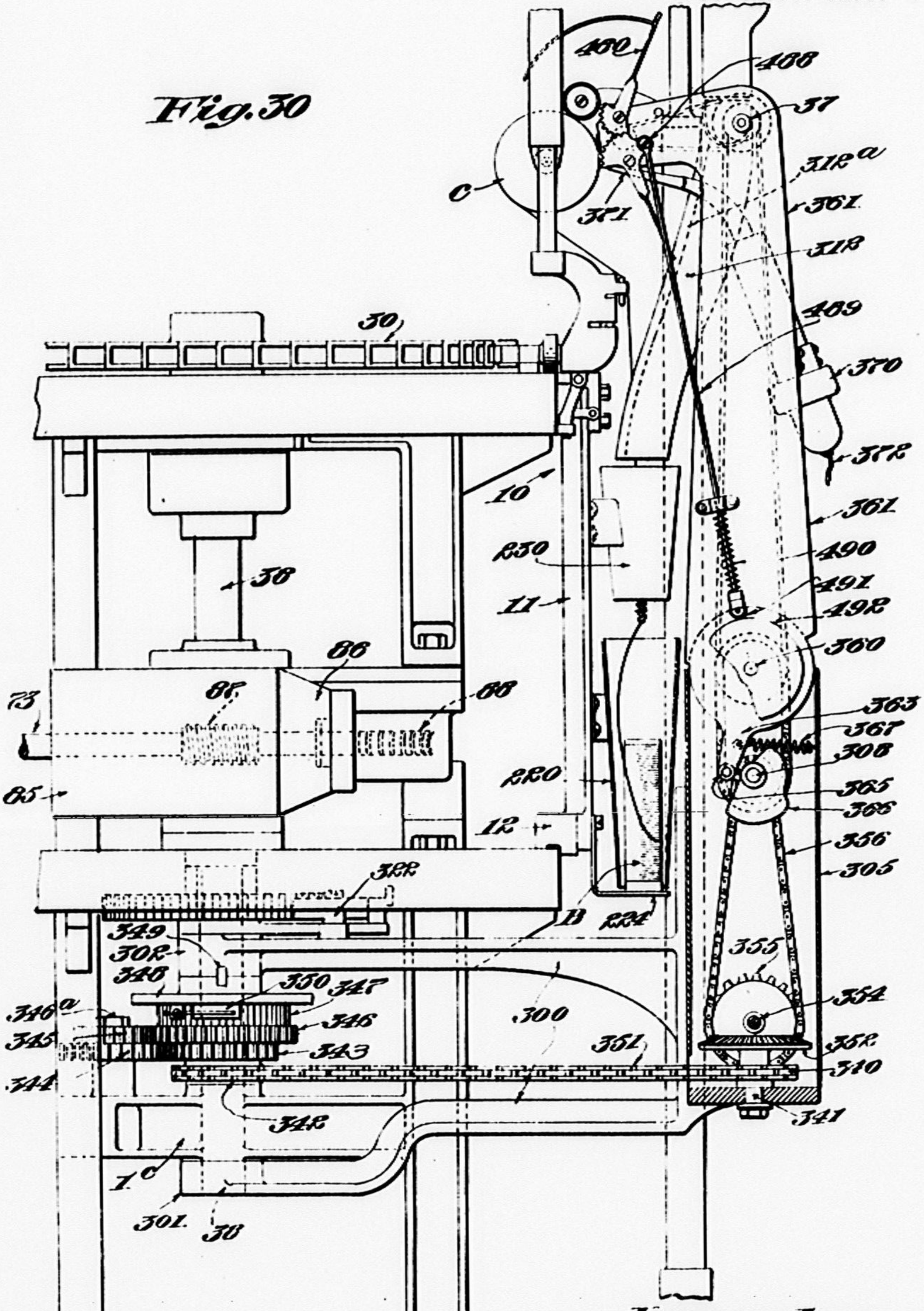
Fig. 30



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Jan. 29, 1929. 1,700,425

E. J. ABBOTT ET AL

AUTOMATIC WINDING MACHINE

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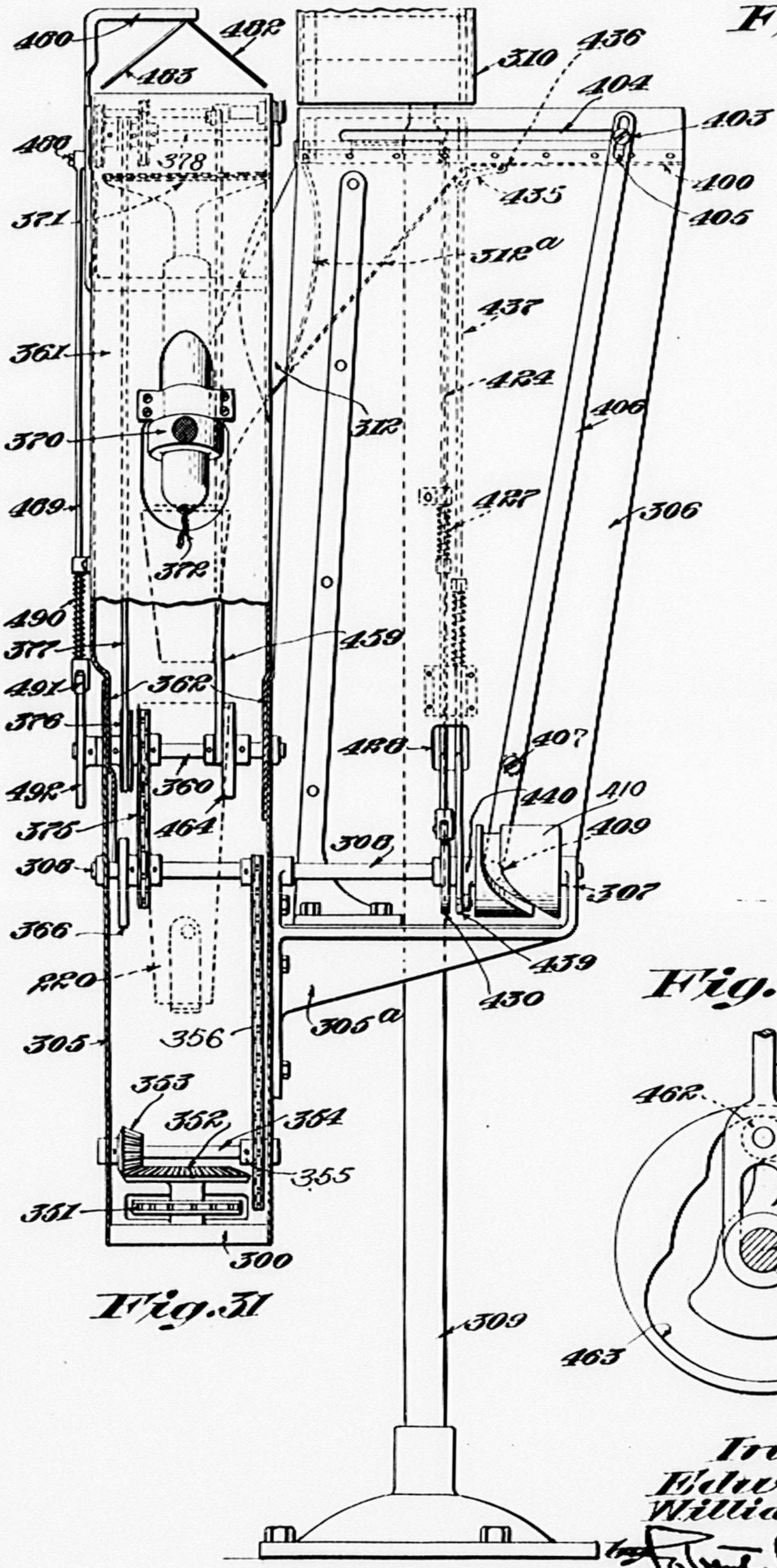


Fig. 31

Fig. 32

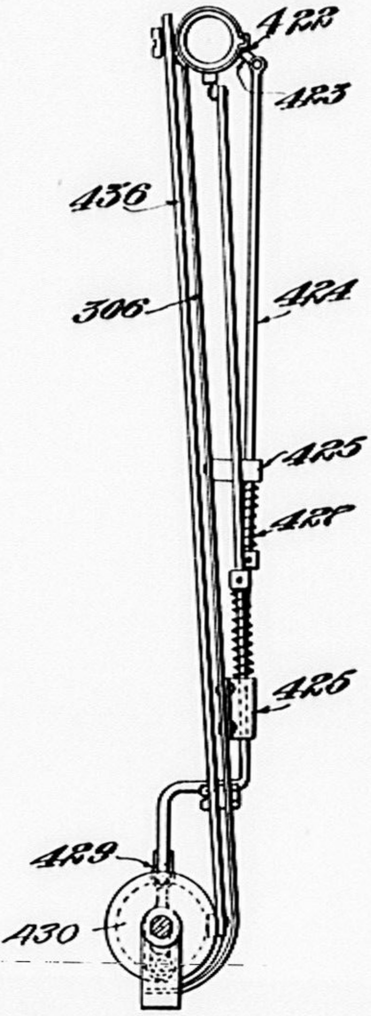
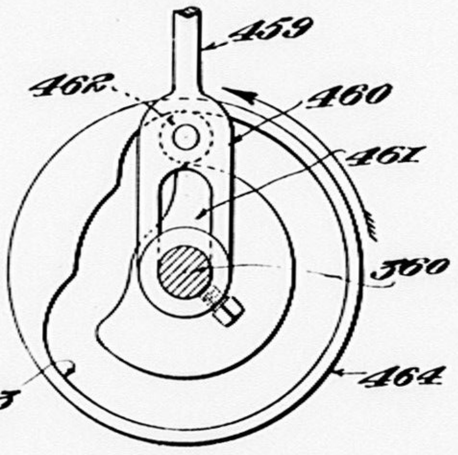


Fig. 33



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Jan. 29, 1929. 1,700,425

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AUTOMATIC WINDING MACHINE

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Fig. 34

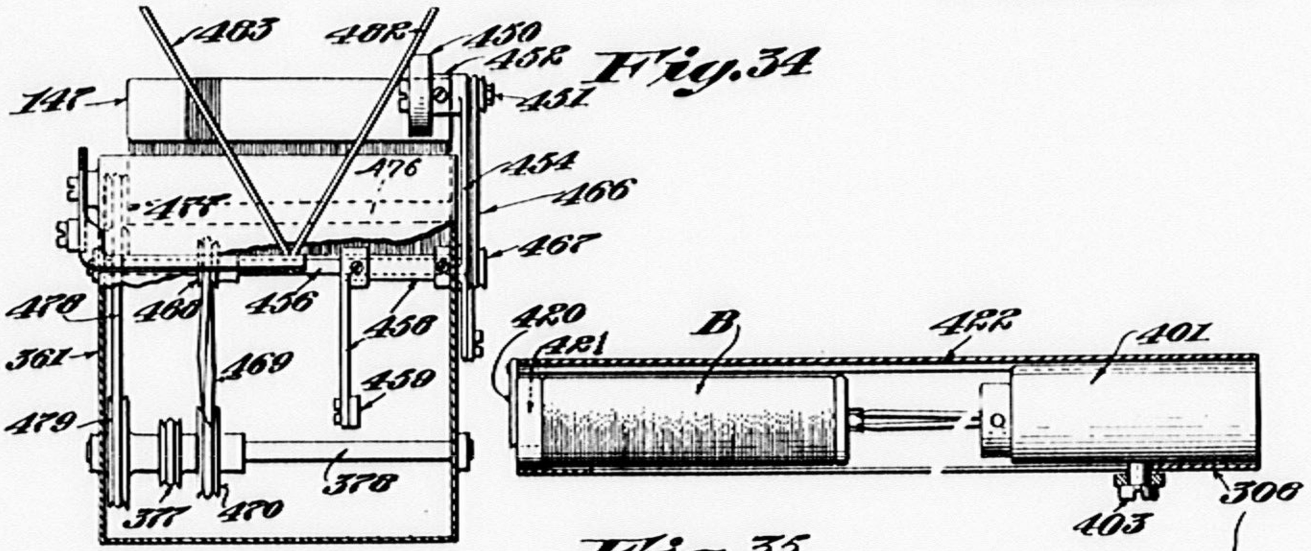

Fig. 35

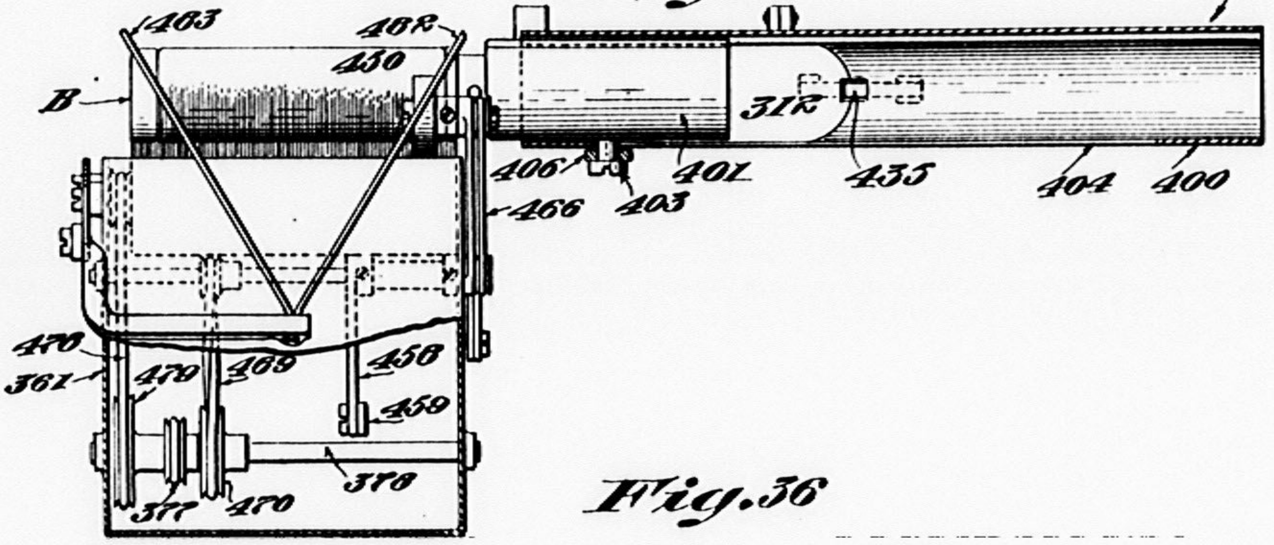

Fig. 36

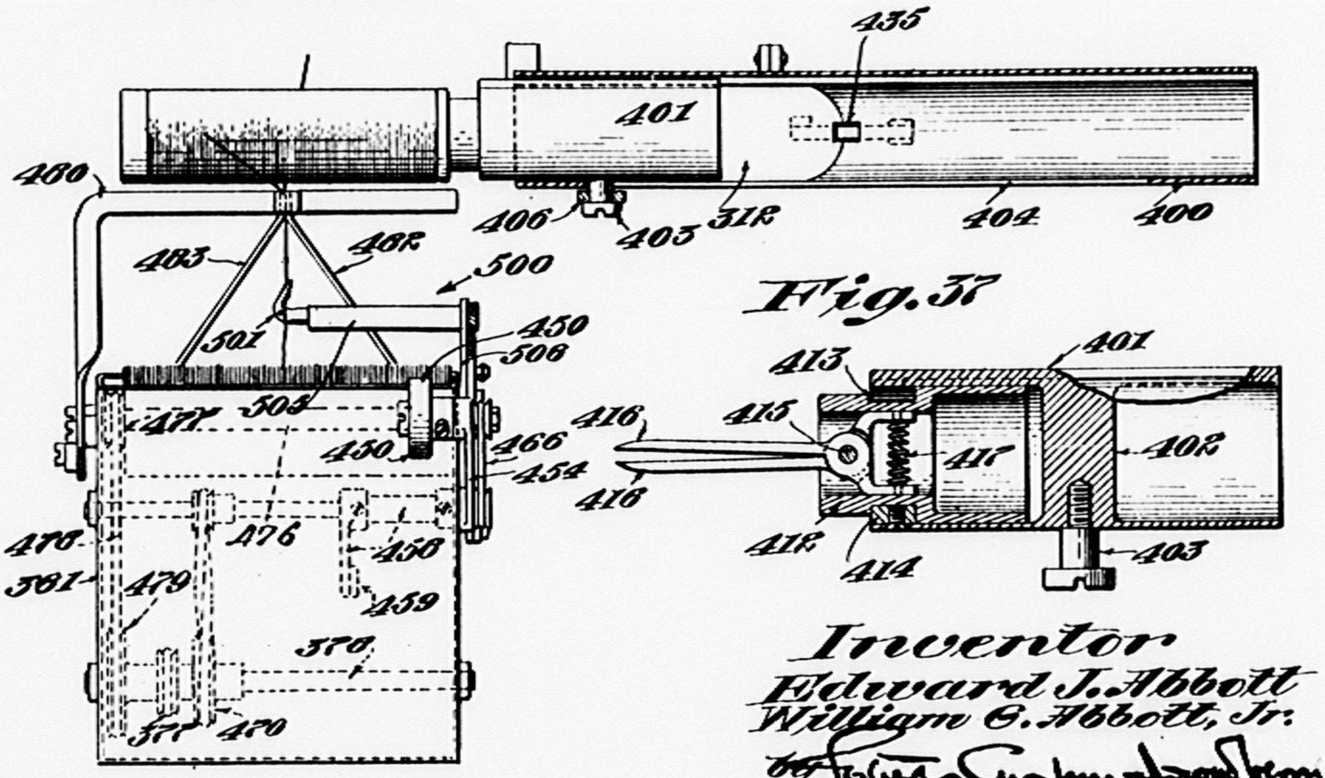

Fig. 37

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Jan. 29, 1929. 1,700,425

E. J. ABBOTT ET AL

AUTOMATIC WINDING MACHINE
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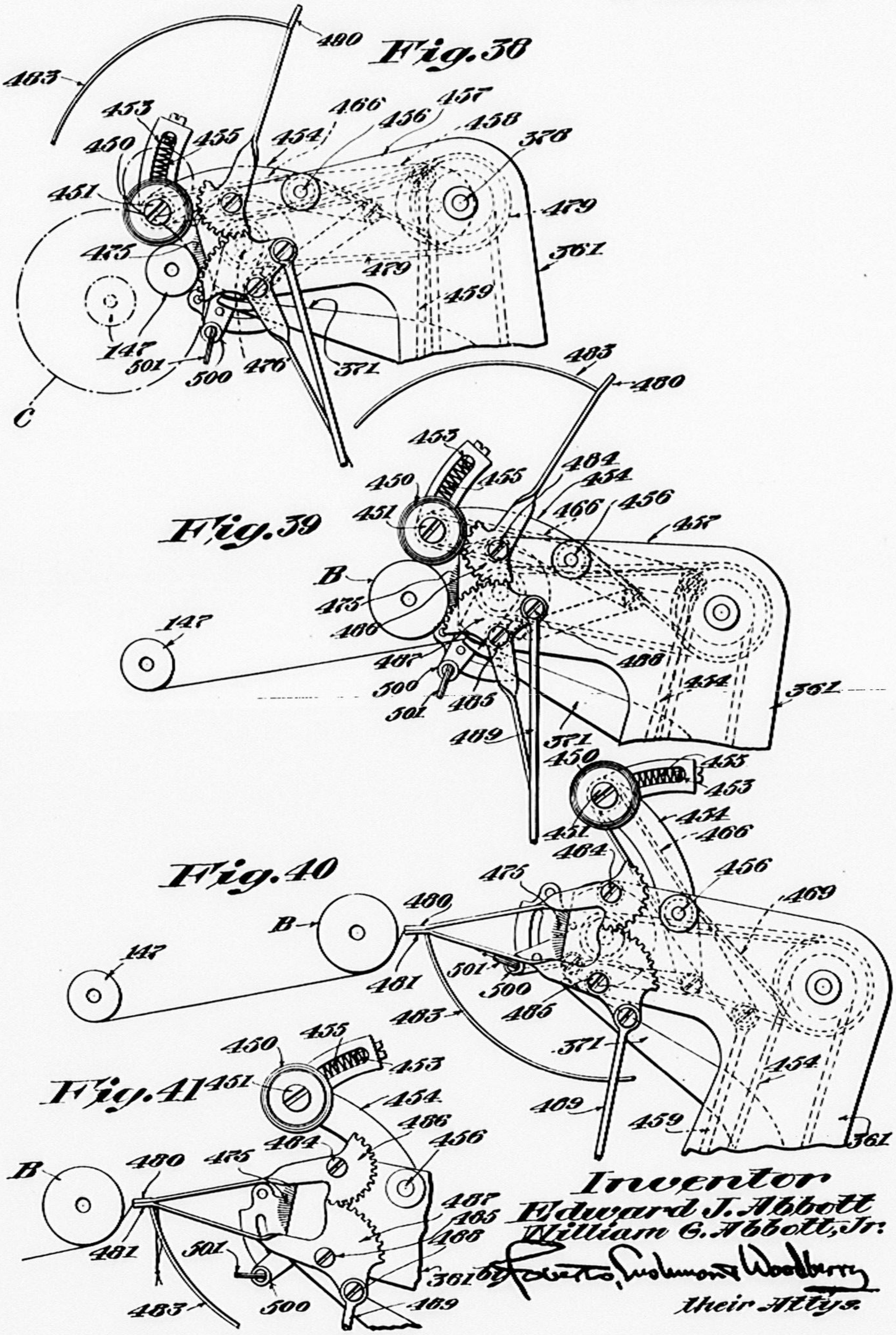

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1,700,425

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AUTOMATIC WINDING MACHINE

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Fig. 42

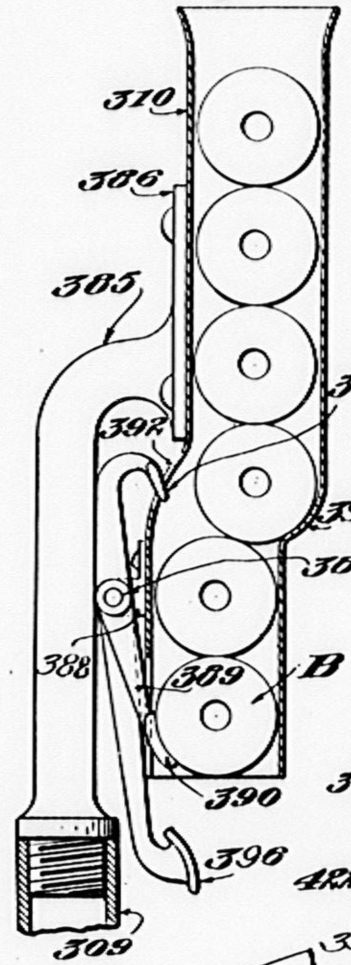


Fig. 43

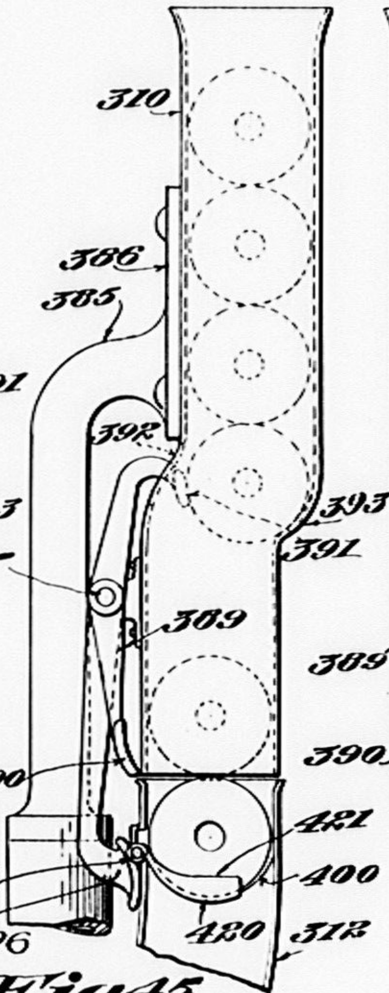


Fig. 44

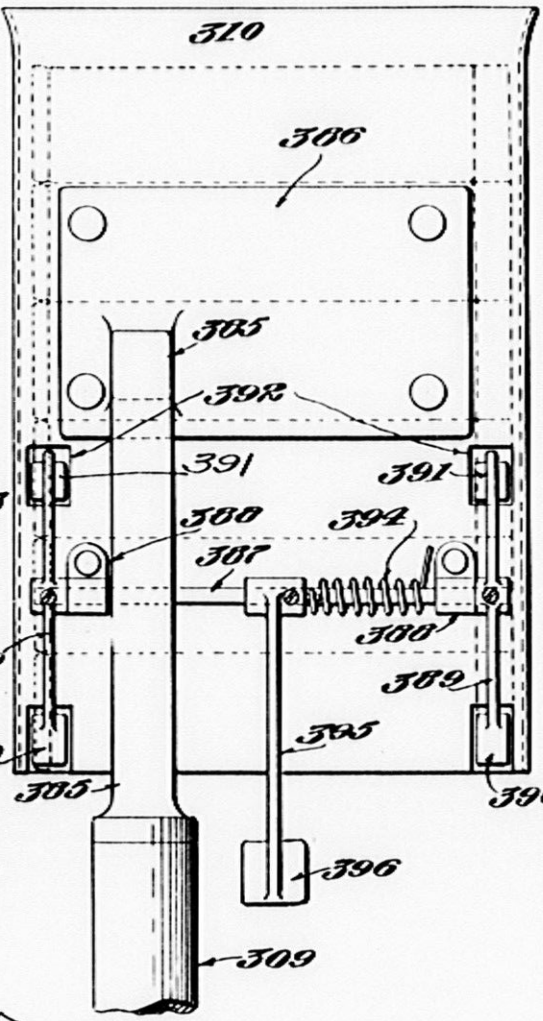


Fig. 45

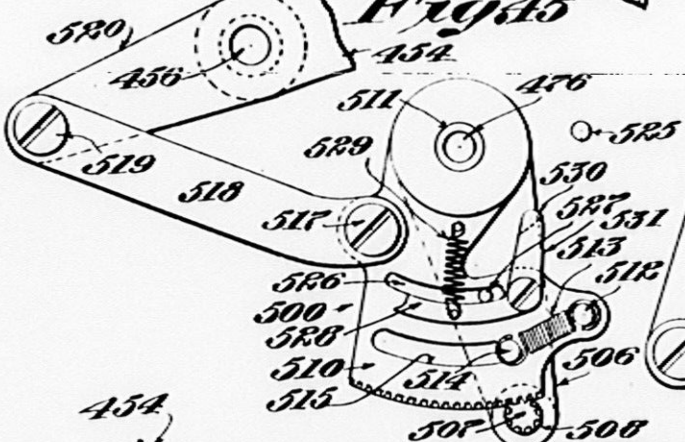


Fig. 46

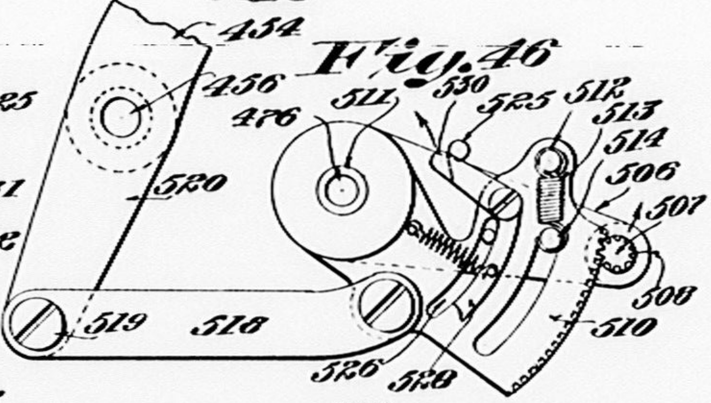


Fig. 47

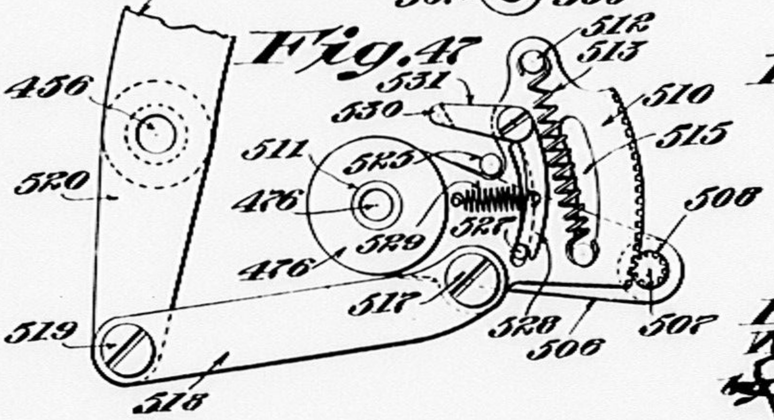
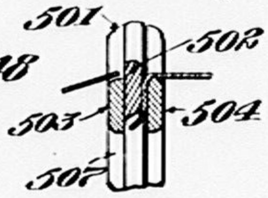


Fig. 48



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E. J. ABBOTT ET AL

AUTOMATIC WINDING MACHINE

Filed Dec. 7, 1926

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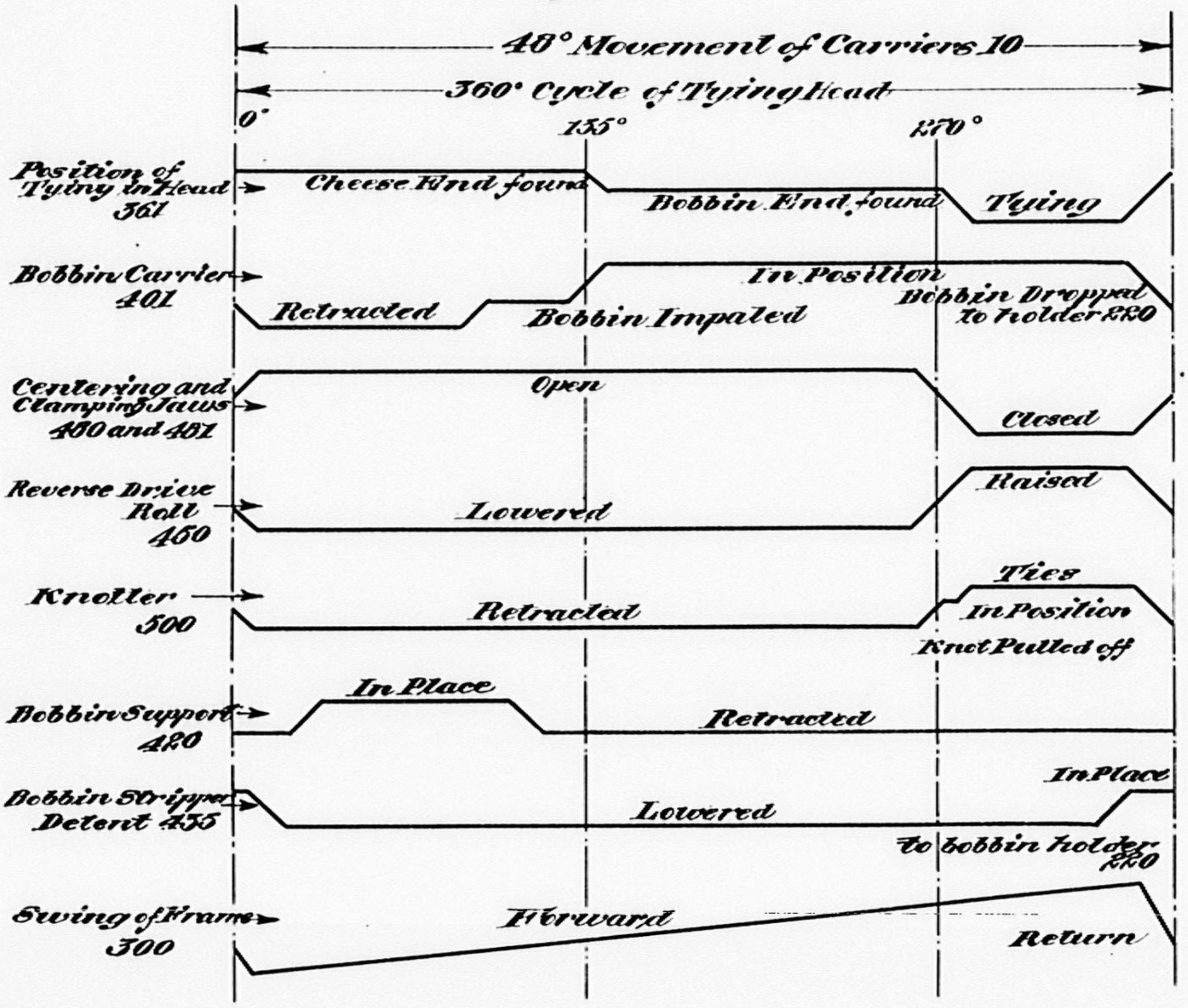
Fig. 49



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Patented Jan. 29, 1929. **1,700,425**

UNITED STATES PATENT OFFICE.

EDWARD J. ABBOTT AND WILLIAM G. ABBOTT, JR., OF WILTON, NEW HAMPSHIRE.

AUTOMATIC WINDING MACHINE.

Application filed December 7, 1926. Serial No. 153,132.

REISSUED

This invention has to do with winding yarn, thread or other filaments (hereinafter referred to as yarn) into traverse-wound packages, such as headless self-sustaining cops, balls or cheeses built up, as usual, of layers of yarn lying in spiral or helical formation, reversals of the direction of pitch of winding occurring at the unsupported end faces constituted of these cusps or reversals. Such a package is suitable for warp for weaving, for rewinding into other packages, for direct use in a warping, knitting, sewing, braiding or other yarn-using machine, or as weft for a continuous-weft loom. As well known to textile artisans, it is necessary to rewind yarn made on a spinning frame and wound on bobbins, for economy of handling and prevention of stoppage of the yarn-using machine, into packages comprising a greater length of yarn than it is possible to wind on the spinning frame bobbin, which can contain a length much less only than that convenient to be used in the ball or cheese constituting the primary yarn supply for the yarn-using machine.

One object of this invention is to provide a machine adapted automatically to wind a self-sustaining headless package comprising the wound lengths of yarn of a plurality of different spinning bobbins or other primary unwinding containers wound on the headless package one after the other, and to provide a machine for this purpose requiring a minimum of attendance which shall be adapted to receive a number of unwinding supply packages, such as spinning bobbins or spools, to wind the contents of unwinding supply bobbins severally into headless traverse-wound packages, and to cause these supplies severally to be replenished automatically by new supplies when exhausted or broken.

In a preferred form, it is a further object of the machine to provide for automatically uniting the exhausted or severed winding end to the leading end of the fresh or replenishment supply; and to provide for tying these two ends together automatically.

Leading to these objects, subordinate objects of the invention are to provide a machine which will detect and remove or doff a complete headless package or cheese; to provide in such a machine automatic devices for discharging a spent unwinding package; to provide in such a machine automatic devices for beginning winding on a fresh spindle, quill, tube or carrier of the leading end of a replenished unwinding supply; and to provide for automatically positioning a fresh unwinding package whenever a predecessor unwinding package is exhausted or its yarn is broken.

A further object of the invention is to provide means to detect and remove knots, enlarging defects, snarls and other imperfections generally known and hereinafter referred to as slubs; or, in case of failure to remove a slub, to break the yarn supply and secure replenishment of the yarn supply; and to provide means to detect breakage or exhaustion of an unwinding supply, and automatically to stop winding of the winding package of that supply until replenishment shall have occured.

A further object of the invention is to provide a machine containing devices to secure some or all of the above objects which will provide for winding the desired kind of wound package during progress of the winding and unwinding yarn packages in a circulatory path and in which the replenishment mechanism the place of delivery of the completed packages, the place of delivery of the spent bobbins and the place of donning or placing a carrier for the winding yarn mass is at one end of the machine, these devices operating at a relatively stationary location.

In pursuit of these objects, the invention provides, among other features and characteristics, in a machine operating to wind one package and unwind another during travel of the winding and unwinding yarn supply, improved devices for supporting, tensioning, detecting exhaustion or breakage of the winding yarn, and for stopping the motion of the winding package upon exhaustion or breakage or the occurrence of a slub, or of any of these; and improved devices for traversing yarn to lay quick-pitched spirals on the surface of a winding container or package during travel along or about a winding machine.

The invention provides devices and combinations of devices for attaining the above and other objects, as well as improved forms of the subordinate combinations and elements of a machine automatically operating to wind the yarns of a plurality of supply bobbins or other unwinding packages in a connected whole on a container or package in the form of a cop, ball or cheese built up of traverse wound layers.

For these purposes, the machine may also include many of the characteristic features and combinations of a machine invented by

Edward J. Abbott and described in his application for patent for winding machines, Serial No. 429,695, filed December 10, 1920 [patented December 7, 1926, No. 1,609,639]. We do not herein claim, therefore, the matters common to said application for patent and this application.

In the accompanying drawings we have shown certain species only of the machine of the invention which will now be described with the aid of the specific instances shown in the drawings, in which:

Fig. 1 is a general plan view of a machine embodying the invention, sections of the length of the machine being broken away;

Fig. 1ª is a detail diagram elevation of certain gearing;

Fig. 2 is a side elevation corresponding to Fig. 1;

Fig. 3 is a typical cross section in elevation on the line 3—3 of Fig. 1, showing a carrier for the winding and unwinding packages and parts of the doffing, stopping and resetting mechanism;

Fig. 3ª is a detail plan view of a part shown in Fig. 3;

Fig. 4 is a detail elevation corresponding to Fig. 3, showing the traversing mechanism and the support for a winding container;

Fig. 5 is a detail section in elevation of one form of tension and detector mechanism;

Fig. 6 is an enlarged detail of a part shown in Fig. 5;

Fig. 7 is a plan corresponding to Fig. 6;

Figs. 8 and 9 are detail plans partly in horizontal section on the line 8—8 of Fig. 17, showing different positions of the winding spindle carriage;

Fig. 10 is an underplan of a part shown in Fig. 9;

Fig. 11 is a detail vertical section corresponding to Fig. 5, illustrating a modified form of yarn tension and slub catching device;

Fig. 12 is a view corresponding to Fig. 11, showing the parts in a different position;

Fig. 13 is a plan of certain parts shown in Fig. 11;

Fig. 14 is a detail elevation illustrating the bobbin gate at the lower end of the unwinding holder;

Fig. 15 is a similar view showing the bobbin gate opened for discharge of an exhaust bobbin;

Figs. 16, 17, 18 and 19 are elevations on a transverse plane, showing different positions of devices relied upon for lifting the winding spindle and winding package;

Fig. 20 is a detail plan and

Fig. 21 is a detailed side elevation of full-cheese doffing and new tube or core donning mechanism;

Fig. 22 [Sheet 1] is an elevation is an elevation of an actuating cam for the doffing slide;

Fig. 23 is a detail elevation on an enlarged scale and partly in vertical section of the tube donning mechanism;

Fig. 24 is a vertical section on the line 24—24 of Fig. 23;

Fig. 25 is a detail section on the line 25—25 of Fig. 24;

Fig. 26 is a detail plan partly in section on line 26—26 of Fig. 2, showing parts of the reciprocating mounting for and certain driving connections for the replenishing mechanism;

Fig. 27 is a detail vertical section of certain driving gears;

Fig. 28 is an enlarged detail in plan including the parts shown in Figs. 27 and 30;

Fig. 29 is an enlarged plan view of a pawl mechanism shown in Fig. 26;

Fig. 30 is an enlarged detail side elevation of the replenishing mechanism;

Fig. 31 is an end elevation showing one operative relation of the replenishing mechanism of Fig. 30 and a supply bobbin magazine;

Fig. 32 is a right side elevation of certain operating connections shown in Fig. 31;

Fig. 33 is a detail left side elevation of an operating cam for replenishment bobbin rotating means;

Figs. 34, 35 and 36 are plans respectively illustrating different positions of supply bobbin and winding package core or tube end-finding and knot-tying devices of the replenishing mechanism;

Fig. 37 is a detail section of supply bobbin presenting devices;

Figs. 38, 39 and 40 are side elevations corresponding respectively to Figs. 34, 35 and 36;

Fig. 41 is a side elevation illustrating a later stage of the tying operation;

Fig. 42 is a vertical detail section of one form of bobbin magazine;

Fig. 43 is a side elevation corresponding to Fig. 42;

Fig. 44 is an end elevation of parts shown in Figs. 42 and 43;

Figs. 45, 46 and 47 are rear side elevations of the knotter positioning and actuator devices;

Fig. 48 is an enlarged plan view of a knotter tying-bill; and

Fig. 49 is a chart relating the times of actuation of the replenishing devices.

A common defect of winding machines in general use resides in the necessity for circulation about the machine of the operator, whose duty it is to replenish the winding packages and to remove the wound packages when finished.

Attendance upon such a machine involves carrying about the machine of heavy weights of fresh supplies of yarn and also involves delay in operation due to the necessity for providing at each winding pair [thereby meaning the unit of unwinding bobbin or package, winding package, supports for these, traverse means, guides and tensions for the winding yarn] means for stopping the operation either upon exhaustion of the yarn being wound or completion of the wound mass, until such time as the circulating operator of the machine can finish replenishing and piecing the supplies at the intervening stopped units and removing all of the intervening and stopped finished packages. This is wasteful of time and attendance and exhausting to the operators, and inefficient in respect to the considerable idle time of winding pairs, lessening the full capacity of the machine, and causing the output of the machine to depend upon the activity and skill of the operators.

In the said application of Edward J. Abbott, Serial No. 429,695 (Patent No. 1,609,639, December 7, 1926) it has been disclosed how to cause the winding pairs comprising a supply bobbin, a traverse mechanism, and a winding package in the form of a headless ball or cheese to progress about the machine so as to bring each winding pair at or about the time of completion of winding from the supply package to the relatively fixed station of an operator at one end of the machine. For these purposes the machine of the said application comprises among other things tractor rolls for driving the winding package along which the winding pairs are progressed during winding; a support for bobbins being unwound holding the bobbins in an erect position for unwinding from one end of the supply package; and a traverse guide and means for operating it causing rapid reciprocation of the traverse guide in the direction of progress of the winding package or cheese along the tractor rolls. In the machine of the said application the operations of replenishing the supply packages, doffing the full cheeses, donning cores, quills or tubes for a new winding for another cheese, and uniting operations for joining the leading end of a supply package to the following end of a winding package are manual operations adapted to be performed by the skilled operator at one end of the machine.

The present invention retains the advantageous mode of operation and construction of the machine of the said application in respect to the arrangement of tractor rolls, the direction and mode of progress of the winding pairs first in one direction along one tractor roll and then in another direction along another tractor roll, and retains in general the driving and gear connections for these purposes.

The present machine provides for the automatic detection of exhaustion or breakage of the supply yarn or of slubs not desirably to be wound into the winding package; provides automatic means for detecting and delivering or doffing the full cheeses; provides automatic means for placing on the winding spindles of the winding pairs a new carrier, core, tube or quill; provides for automatically beginning winding on the new carrier or core for a newly begun package or cheese by automatically delivering the spent bobbin or carrier for the unwinding supply; provides for automatically replenishing in respect to the winding carrier and spent supply by providing and positioning a new supply by automatically uniting the leading end of the new supply to the following end of a broken or exhausted supply or to a starting winding on the winding package carrier; and further provides for accomplishing these operations at one end of a circulating winding machine having the advantages of the machine of the said Edward J. Abbott application, by accomplishing the circulation about the machine of winding pairs in about the time required to wind all of the yarn off of one supply package onto the forming cheese, so that in normal operation the unwinding carriers are exhausted when they reach the replenishing mechanism.

In a preferred form the machine, referring now to Figs. 1 and 2 of the drawings, comprises end frames 1 and intermediate frames 2 in any desired number shown as castings, see Fig. 3, having suitable seats for upper longitudinal rails 5, 5. Other longitudinal struts may, if desired, be provided, for instance as shown at 6, to increase the strength and rigidity of the framework, which may be of any suitable form for supporting the working parts. A sufficient number of frames 2 is provided to build a machine of the desired length, and this length may be dictated by the length of the unbroken yarn on the usual unwinding packages, the speed of circulation of the winding pairs, and the linear speed of winding on the winding package, as further referred to below. Whether or not the frames 1 are provided with sufficient longitudinal struts to stand alone without aid from the rails 4 and 5, these rails are bent, for example at 4^a, 5^a, in semi-circular curves about centers at the respective ends of the machine. The rails 4 and 5 therefore provide vertically spaced endless tracks for the winding and unwinding pair carriers 10.

The circulating carriers.—Preferably the carriers 10 are constructed as best shown in Figs. 1, 2, 3, and 4 as substantially upright T-section frames 11 having grooved lugs at their lower ends at 12 straddling the rail 5; having an upper bearing frame construction having spaced ends 13, and a central downwardly extending lug 14 bolted to the upper end of the frame 11, the frame 13, 13 having rearwardly extending bifurcated legs 15 providing a bearing for anti-friction rolls 16 resting on rail 4, and said frame 13 carrying at one end an upwardly extending arm 17 backwardly curved, terminating in a boss 18 on which is erected an upright slide shaft 19 bearing a key or gib 20 and having mounted at the upper end thereof a cap 21 serving as a bearing place for certain members presently mentioned.

The frames 13 may further carry antifriction rolls 22 and 23 respectively taking against the rear and front faces of the rail 4. The carriers 10 are circulated about the straight sides and semi-circular ends of the rails 4 and 5 by any suitable driving connection to an endless chain 30 running substantially parallel to, within and near the rail 4; for example links 25, Fig. 1, are pivoted respectively to the lugs 15 at the rear side of the frames 13 and to projections from appropriate links in chain 30, so that the points of attachment of the chain 30 may be shifted to different distances from the rail 4 during motion of the carriers 10 around the ends of the machine.

Driving connections.—Any suitable means for driving the chain 30 at the desired speed may be employed. Preferred means illustrated in the drawings comprise sprocket wheels 35 and 36 at the respective ends of the machine respectively mounted on vertical shafts 37 and 38. Shaft 37 may be fixed in a bearing 39 which, if desired, may be longitudinally adjustable in respect to the frame 1, for example by means (not shown) of the said application for patent. Shaft 38 may be similarly mounted in the bearing block 40 on the right hand end frame 1, but this shaft is keyed to the sprocket 36 and suitably driven to move the chain 30. The vertical shaft 38 is driven as presently described.

Referring to Figs. 1, 1ᵃ, 2, 3, and 4, the winding package is driven by driving contact with one or the other of the longitudinal tractor rolls 50, 51 which preferably extend along the machine above the rails 4 between end bearings in brackets 52, 52 at the rear end of the machine and end bearing brackets 53, 53 formed as a part of a hollow transverse gear casing 55 extending across the front end of the machine inward of the right end bearing frame, Fig. 1.

Casing 55 has appropriate bearings for like short shafts 56 and 60 (of which shaft 56 may be employed as a main driving shaft, bearing for this purpose a pulley 57 driven by a belt 58 from an overhead clutch pulley, (not shown) and for this purpose the casing may be rigidly bolted to longitudinal struts extending between the end frame 1 and the adjacent frame 2. Within the casing 55 shafts 56 and 60 are gearing together as shown in diagram in Fig. 1ᵃ by like gears 62, 63 in turn meshing with idler pinions 64 and 65 on stud shafts 66, 67 within the gear casing 55. Idler pinions 64 and 65 in turn mesh with the drive pinions 68 and 69 formed on or attached to the ends of the respective tractor rolls 50, 51. When the shaft 56 is driven the tractor rolls are driven at like relatively high speeds in opposite directions, so that their upper surfaces rotate inwardly toward the machine. The primary drive may of course be applied instead to any element of these connected rotary parts.

At suitable intervals in the length of the rolls 50, 51, these rolls may be supported by uncapped bearings on brackets forming part of the frames 2, with the effect that the upper surface of the rolls 50 or 51 is free to support and drive a winding ball or cheese carried by a winding spindle 26 projecting at right angles from a boss at the bottom of a hollow slide 27, Figs. 3 and 4.

The shaft 60 may carry a pulley 70 driving a belt 71, in turn driving a pulley 72 on a longitudinal shaft 73 in bearings in the frames 1 and 2. One end of the shaft 73 carries a pinion 74, Figs. 1 and 2, engaging a much larger gear 75 having attached to one face a cam 76 presently referred to, and fast upon a primary cam shaft 77 geared at 78, 78 to a secondary cam shaft 79, all in bearings in the frames 2. The left or back end of the shaft 79 carries a tappet cam 80 for use presently mentioned. The right or front end of the shaft 77 carries a tappet cam 81 for use presently mentioned.

The right hand end of the longitudinal shaft 73, see Fig. 30, finds a bearing in the casing 85 containing a thrust bearing at 86. Integral with or attached to the shaft 73 within the casing 85 is a suitable driving worm 87 for a worm gear 88 keyed to the shaft 38. The shaft 73, its worm, and the gear 88 thereby drive the shaft 38 and the chain 30. Certain other parts are actuated from the shaft 38 as presently mentioned.

It will be observed, from the operation of the machine so far as described, that there is constant actuation of the tractor rolls 50, 51 which may be driven at speeds exceeding 1200 revolutions per minute, and that the rotation of these tractor rolls is related to the motion of translation imparted to the winding packages and the unwinding packages carried by the carriers 10. The carriers 10 may move, for example, at the rate of ten feet per minute.

It is desirable to so operate upon the winding package carried by the carriers 10 as to cease actuation during the progress around the ends of the machine of these carriers and the load carried by them. It is desirable also to cease actuation of the traverse motion by which the unwinding yarn is laid upon the surface of the cheese or other packages driven by the tractor rolls 50, 51.

Referring now to Figs. 1, 2, 3, and 4, devices are provided for consecutively lifting the hollow slides 27 carrying the winding spindles 26 as they are about to pass off of the respective tractor rolls 50, 51. On a frame 2 near the front of the machine as shown in Fig. 3 a slidway 90 is erected to receive a slide 91 connected by a link 92 to a lever 93 pivoted at 94 to the opposite side of the frame 2. The lever 93 lies over the tappet cam 81 at this end of the machine, and the relation of motion of the shaft 77 to the motion of the chain 30 is such as to lift the slide 91 at each passage by it of the vertical slide shaft 19 of each of the carriers 10. The hollow slides 27 are each provided with an anti-friction roller 95 on a stud 96 to engage a T-head 97 on a bell crank lever 98, 99 pivoted at 100 for limited motion in respect to slide 91. A relatively weak spring 101 normally supports the lever 98 at the top of its limited motion. Mounted on the slide 91 (see also Figs. 16, 17, 18 and 19) is a latch lever 102 pivoted at 103 for control by a leaf spring 103^a mounted on an indicator 104 on the pivot 103.

When the anti-friction roll is in a low position such as shown in Fig. 3 upward motion of slide 91 will cause the T-head 97 on lever 98 to be depressed in relation to the slide 91, the lever 102 and spring 103^a being free to drop to the position shown in Fig. 3. Under these circumstances the lifting motion of the slide 91 is sufficient to carry the hollow slide 27 to a height to engage a lug 28 of said slide behind a bell-crank latch lever 105 mounted on the head 21 of each vertical slide shaft 19.

The slideway 90 carries a vertically adjustable cam 106 adapted to move the lever 102 and latch the depending arm 99 of the lever 98, 99 so that the slight freedom of motion permitted against the spring 101 may not take place on encounter of the crutch head 97 with the anti-friction roll 95. But this will not take place unless the anti-friction roll 95 is in a relatively elevated position, see Fig. 16, as will occur when the cheese C being wound is of a predetermined diameter or a greater diameter. In that case the cam 106 will have latched the arm 99 of the lever 98, 99 before the roll 95, the height of which measures a radius of the wound cheese, is reached, and as a result of this the hollow slide 27 will be lifted a measured distance further than is necessary merely to latch the lug 28 by the latch lever 105.

Projecting inwardly from the hollow slide 27 a stud 29 is provided to engage with a depending cam 107 mounted in a slot in the cap 21 whenever the hollow slide 27 is lifted abnormally by locking the lever 98, 99 in its upper position.

The key 20 in the keyway on the hollow slide 27 ends in a position to permit movement induced by the stud 29 on the cam 107 whenever this abnormal lifting motion takes place. As a consequence of this arrangement, whenever there is a full cheese on the spindle 26 at the time of passage from the roll 50 and before the carriers 10 move around the front end of the machine, the hollow slide 27, the spindle and the full cheese will be turned about one slide shaft 19 to the position best shown in Fig. 1 at an angle of about 30° to normal position. This brings the full cheese within the influence of doffing or discharging means, and positions the spindle 26 to receive a new carrier or tube for another winding package.

The traversing mechanism.—The frame 13 of the carrier 10 for the winding and unwinding pairs is provided with means for guiding the yarn in the quick-pitched or steep spirals desirable to build up a headless wound package, such as the well-known Fiji package mentioned above, in which the heads or ends of the ball or cheese are relatively perpendicular to the winding axis and comprised of the cusps or reversals of the spires of the winding in each layer. For these purposes, preferred devices shown in the drawings comprise a rotary traverse cam made as a barrel cam 115, Figs. 2, 3 and 4, having an endless cam path 116 of the desired number of turns and having projecting end journals 117 having their bearings in slots 118 in the frames 13, and provided with bearing blocks 119 movable inwardly in the slots under the influence of springs 120. The cam 115 is provided with tractor rings 121, which may be soft metal rings fast on each end of the barrel cam and projecting slightly above its general surface. These rings are normally forced by the springs 120 into contact with the rolls 50 and 51 to be driven thereby.

Parallel with the axis of the rolls 50, 51 when the device is in use and with the axis of rotation of the cam 115 the frames 13 also carry guide bars 122, 123 and straddling these two parallel guides a block 124 bored for the guide 123 and slotted for the guide 122 carries a depending pivoted follower 125 and an upwardly projecting cam-edged lug 126 having a central guiding slot for the yarn. On the outer face of the frames 113 in suitable lugs the polished guide bar 127 provides an out-board support for yarns going to the winding surface from the supply.

The arrangement is such that the rapidly reciprocating guide 126 projects into the path of the yarn guided by the guide 127 and the upper surface of one of the tractor rolls 50, 51, and by reason of the cam edges of the guide 126 picks up and reciprocates the yarn in a direction parallel to the winding axis.

It is desirable to remove the contact rings 122 from driving contact with the rolls 50 at times when the hollow slide 27 is lifted. For this purpose the frames 13 may carry a rock shaft 130 having a depending lever 131 adapted to be latched in an outward position by a gravity latch 132 pivoted at 133 in a part of the frame 13. Eccentrically disposed arms 135 at the ends of the rock shaft 130 take under the lower ends of vertical slide wedges

136 in ways in frame 13, so that when the lever 131 is rocked inwardly with shaft 130 the cam 115 is axially moved outward, the driving sleeves 121 are forced out of contact with the rolls 50 or 51.

On the rails 4 at appropriate places near the ends of the tractor rolls 50, 51 in the direction of motion of the carriers 10 suitable cams 138 lift the lever 131 to the outward position. Suitable cams 139, see Fig. 2, on the rail 4 may be provided to lift the latch 132 to release the lever 131 and permit the wedges 136 to drop and thus to restore the parts to operation. Cams 138 and 139, not shown, may be placed on the run of the track 4 at the ends of roll 51, for the same purpose.

Referring now to Figs. 1 and 2, means are provided to drop the slides 27 so as to bring the winding package onto the tractor rolls 50, 51 at the beginning of their passage along either of the tractor rolls. Preferred means for this purpose comprises standards 140, 140 having at their upper ends forwardly projecting cams 141 which act with the cam tails 142 of the latch levers 105 mounted at the heads of the respective slide shaft 19.

The standard 140 may also carry a friction spring 143 adapted to engage a core or partly wound cheese above its axis to insure that the tube is thrust as far as it will go on spindle 26 and to set the cheese rotating on its spindle before it is dropped on the roll 50 or 51.

Doffing and winding-package core donning mechanism.—Referring now to Figs. 1 to 4 and 16 to 25 inclusive, whenever a full cheese has been abnormally lifted by the operation of the slide 91 and lever 98, and when the cam 107 and stud 29 have cooperated to turn the hollow spindle carriage 27 outwardly, as above explained, the parts are held in this position, as by the V-shaped upper end of the key 20 taking into a V-slot 140, Fig. 10, on the under face of the slide 27, the slide 27, spindle 26 and its carried package continuing to travel with chain 30 toward and beyond the position shown in Fig. 1, and at a higher level than any operative position of the spindle 26 and slide 27.

In this position the full cheese passes, by continued travel with chain 30, the place of operation of devices adapted to remove the cheese and its tubular core endwise from the spindle, and to place a new core on the spindle. Any effective means for this purpose may be resorted to, but in a preferred form the machine is provided with an auxiliary bridge frame having a horizontal member 145 and a vertical member 146 erected on one of the frames 2 and its outer end supported by a floor standard 150, which standard may carry a magazine 148 and feeding mechanism for whatever kind of tubular carrier or core upon which it may be desired to wind the wound product of the machine; for example, as shown, these carrier cores may be wooden or molded-composition cylindrical tubes 147 having flared-end central bores and preferably carrying a short prewinding of any suitable yarn at 149 to facilitate automatic starting of winding by automatically uniting to the pre-winding the leading end of a new yarn supply. Preferably the magazine 148 loosely supports a vertical column of cores 147 and is adapted to permit the bottommost core to be removed endwise by core-donning mechanism also carried by standard 150 and presently to be explained; but any suitable magazine and feed may be resorted to within some expressions of this invention.

Member 145 of the bridge frame is longitudinally grooved at 151 to receive a reciprocating connector 152 continued by a rack 153 in a slot in vertical member 146, meshing with a pinion 154 fast on a short shaft 155 in bores in a lug of member 146 and in a bore in a rack guide 156 which may be fastened to or form a part of member 146, shaft 155 carrying a pinion 157 meshing with a vertical rack 158 on a twisted bar 159 bearing at its lower end an anti-friction roll 160 adapted to take into the cam path 161 of the cam 76, Figs. 1, 2 and 22.

The connector 152 carries a depending pusher 162 adapted to strike and move to the right of Figs. 21 and 22 the full cheeses on the reciprocal stroke to the right of pusher 162, as given in time with the motion of chain 30 by the cam 76, 161 and the rack and pinion connection 159, 153, etc. The cam track 161 is relatively steep, so that the motion of the pusher 162 is rapid in relation to travel of the chain 30 and the wound cheeses in the direction of the arrow *a*, Figs. 1 and 20. The slope of the direction of motion of the pusher 162 in relation to the proper motion of the travelling wound cheese is such as to minimize shock of contact and to result in slightly rotating the doffed wound mass and its core on its spindle 26 to aid doffing; preferably doffing is completed and the full cheese dropped before the axis of spindle 26 reaches the plane of the replenishment cores in magazine 148.

The full cheese doffed by the pusher 162 as soon as released from spindle 26 drops into a gravity chute 175 leading to an enclosed conveyor 176, which may deliver wound cheeses at any desired point.

The doffed cheese is preferably caused automatically to initiate replenishment of a new winding carrier or core 147, in order to insure discharge of the full cheese, for example by tripping in its fall a trigger 180 controlling the operation of motor-actuated core feeding means cooperating with the supply of cores or carriers in magazine 148. Referring to Figs. 21 to 25, the core feeding means may comprise a spring motor having a spring drum 185 and attached pinion 193 fast to the outer end of a spiral spring 186 fast at its inner convolution to the horizontal headed stud shaft 187 mounted in a bored boss of a motor casing 188 attached to or forming a part of the magazine 148. Shaft 187 also carries a winding gear 189 meshing with a rack 190, Figs. 21 and 24, attached to the connector 152; gear 189 carries a spring pawl 191 adapted to take into a notch 192 in drum 185 on a stroke to the right of rack 190, and rotate drum 185 and pinion 193 clockwise as viewed in Fig. 23. Pivoted at 194 in casing 188 a driver lever 195 is provided with a rack segment 196 meshing with gear 193, and at its lower end with a slot embracing an anti-friction roll 197 on a cranked connector arm 198 extending through a slot 199 common to magazine 148 and casing 188 into a hole in a driver 200, which may be a hollow steel cylinder sliding in a tubular extension 201 of magazine 148. Driver 200 moves to the right of Fig. 23 on motion to the right of rack 190, and in this position a lug 202 of trigger 180, which is pivoted at 203 to casing 188, enters a hole in extension 201 and locks against the left face of driver 200. Trigger 180 is lifted for this purpose by an arm 204, Fig. 24, taking into a hole in the bottom of a pawl lifter 205 in vertical bores in lugs 206, 206 of casing 188 and held upward by spring 207. When the lug 202 of trigger 180 has engaged in front of driver 200, pawl lifter 205 is positioned to strike the tail of pawl 191, to release drum 185 while gear 189 moves with rack 190 on its left-hand stroke, which begins immediately. But rotation of the pinion 193 and drum 185 by spring 186 is restrained by the trigger 180 acting through driver 200, lever 195 and segment 196, until a full cheese depresses trigger 180.

Motion of driver 200 to the right has now permitted a core 147 to fall to the bottom of its magazine in line with driver 200, and pressing trigger 180 causes the described spring motor acting through lever 195 and driver 200 forcibly to project the waiting core to the left of Fig. 21 and cause it to take over the spindle 26, at that time in alignment with its central bore.

The spindle 26 and new core 147 are now restored to axial alignment with the circulatory path of travel. The bridge-frame member 145 or some other fixed part of the frame of the machine may support a wiper 165, Figs. 8, 9 and 20, preferably a stiff depending plate spring mounted on a bracket 166 in the path of the roller 96 on the lifted carriage 27, and thus adapted to rotate the carriage 27 to bring the key 20 in line with its keyway, whereupon the carriage 20 drops free of wiper 165 and so far as the lug 28 and latch 105 will permit. The axis of spindle 26 is thus also restored to the vertical plane of the axis of tractor roll 50, which is one of its normal positions, ready to begin winding when lowered onto the roll 51, after replenishment of the unwinding supply.

The unwinding supply devices.—Referring to Figs. 1, 2, 3, 5 to 7, 14, 15, and 30, ordinary use of the machine of this invention results in winding on the winding package the normal length of one supply package of yarn, usually a spinning bobbin, in one whole traverse of the carriers 10 along roll 51 and roll 50. The supply packages are therefore normally exhausted when they approach the right end of their circulatory path of motion as viewed in Figs. 1 and 2, and the usual operation includes automatically removing the spent bobbins. It is better practice also to remove and replace with full bobbins, supply bobbins partially empty by reason of breakage, and to recover these from the spent bobbins for rewinding to full condition. The machine therefore includes on each of the carriers 10 suitable supply bobbin holders and adjunctive means adapted to discharge spent or partially spent bobbins and replace them with others at the right end of the machine, as viewed in Figs. 1 and 2.

The carriers 10 are therefore provided with gravity charge and discharge devices, and with supports for the unwinding bobbins, hereinafter generically referred to as unwinding holders. In the preferred form, referring now to Figs. 3, 14, 15 and 30 particularly, these instruments may be made in the form of conical sleeves open at both ends, with the larger end up as shown at 220 mounted in an erect position in any suitable way on the lower interior surface of the carriers 10; for example electrically welded or soldered lugs 221 on unwinding holders 220 may be screwed or bolted to the channel 11.

On the lower end of the channel 11 opposite the bifurcated guide lug 12 a gravity gate 222 eccentrically pivoted at 223 and comprising a horizontal stop 224 and a limit stop pin 225 may be provided. The interior diameter of the unwinding holders 220 is such that the unwinding package or bobbin B may rest freely on the portion 224 of the gate in such a position as to stand by gravity and to impose no obstruction 70 unwinding over the upper end of the bobbin or other package B.

The machine is so arranged as to discharge spent bobbins B by gravity. At an appropriate place on the rail 5 following a place at which in the normal operation the bobbins B may be completely unwound, the rail 5 may be equipped within an appropriate detent 226 against which the member 224 of the gate 223 takes upon the motion of the carriers 10 past its position, this as best shown in Figs 14 and 15. This swings the gate member against gravity and drops the bobbins. The spent bobbins may be received, see Figs. 1 and 2, in a gravity chute 227 leading to the belt conveyor 228 adapted to deliver the spent bobbins wherever desired. As best shown in Fig. 2, the gate opener detent 226 may operate at a point following the operation of the cheese-lifting devices 97 at the following end of the traverse along the roll 50, and the delivery of the spent bobbins may take place just prior to the operation of the full-cheese doffing devices above described.

Tension devices, exhaustion, braking, and slub detecting mechanism; winding package stop motion.—Bearing in mind that it is intended to place new bobbins in the unwinding holders 220 to replace the exhausted or otherwise discharged bobbins, it is desirable to provide devices for tension and stop motion detector purposes adapted to be rethreaded and reset either upon the mere appearance and passage through them of the replenishment supply, or by timely operation as a consequence of the progress of the carriers 10.

One form of device for this purpose is illustrated in Figs. 3, 5, 6, 7. Axially in alignment with unwinding holders 220 of each carrier 10 the depending channel 11 carries a directing support 230, which may be a conical sleeve like the holder 220 mounted at 231 in a similar way and having its larger end upward. As presently to be described, replenishment bobbins may be dropped through the directing support 230 from a communicating chute, and it is desirable that the mere passage of a bobbin to the unwinding holder 220, the unwinding end being detained aloft, may perform all of the operations necessary to thread the unwinding end through tension and detector devices. For one example of such devices, on directing support 230 may be soldered or otherwise fastened a bent wire 232 providing a horizontal pivot at 233 for a coil 234 of a corkscrew guide, tension and slub catcher lever 235, upon which a light counterweight 236 may tend to keep the depending spiral 237 and the vertical post 238 and a bent end 239 in an upper operative position in which the post 238 is axially disposed in the directing support 230. The bent portion 239 may terminate in an eye 240 in which and in a hole in a light steel slub-catching plate 241, a binding bolt 242 may take to mount the slub-catching plate 241 in the relation best illustrated in Figs. 6 and 7. As shown in Fig. 5, the bobbin B falling through the directing support 230 strikes and moves out of the way the portions 239, 237, 241 of the lever 235, but after passage of the bobbin these parts are restored to normal operative position by weight 236. Upon attempting to unwind the bobbin, now in the holder 220, the ballooning rotation of the yarn wraps the yarn through the spires of the spiral 237 to the final position indicated in Fig. 6, in which it will be observed that the final run of the yarn around the tensioning portion 238 passes between the slub-catching plate 241 and the horizontal arm 239.

The wrapping of yarns about the portion 238 provides a normal tension for the unwinding yarn. If, for any reason, the tension should become abnormal, or if a slub should pass between the plate 241 and the arm 239, there will be an upward stress upon the lever 235.

Normally this stress is resisted by the bent end 245 of a light bell crank lever having a sleeve pivoted on the wire 233 and connected by link 246 to a bell crank lever 247 pivoted on the rear face of the directing support 230. Lever 247 is bored for a detent at the end of a link 248 extending upwardly to the lever 249, (see Fig. 4 also) pivoted on the boss 18 of the frame 13 and having one end taking under a bent trigger lever 250 pivoted on the rear face of a bracket 252, and adapted to move against a light spring 251. Bracket 252 supports a short rigid pivot shaft 253, in turn supporting a stop lever 255 terminating in a segmental winding package lifting brake and shield 257, which may extend parallel with spindle 26 for a sufficient distance.

A relatively strong spring 258 tends to throw the lever 255 to a position to insert the segmental shield 257 between the winding package and the traveling roll 50. This tendency is resisted by the trigger lever 250, which bears just above a notch in lever 255, until a pull on link 248 releases the trigger lever. It will be obvious that any abnormal stress on the bent end 245 due to the occurence of a slub or abnormal tension will release the stop lever 253 and shield 257 to lift and brake the winding package to cease winding.

The same devices may be utilized for stopping winding and braking rotating of the winding package on exhaustion or breakage of the unwinding yarn. Referring to Fig. 3, in a vertical slot in the rear face of the bottom end of the unwinding holder 220 a wire lever 260 pivoted at 261 between the lugs 221 is normally held to the left of Fig. 3 at its upper end by the bottom of the replenishment bobbin B. The upper end of the lever 260, see Fig. 3^a, rests near a bend 262 in a bent wire detector arm 263 integral with a light rock shaft 264 held by suitable staple rivets to move on the front face of the channel 11, and having at its upper end a fork 265 taking over the link 246. A light spring 267 tends to pull detector arm 263 toward the observer in Fig. 3, but this motion is restrained normally by the run of yarn Y extending from the unwinding holder 220 through the directing support 230. But when the bobbin has been discharged from the unwinding holder 220, light spring 268 surrounding pivot 261 causes the lever 260 to react with the lug 262 on the arm 263 to remove the arm 263 out of the way of an incoming bobbin. The detector arm 263 is released to bear on the yarn after a new supply has been put into the unwinding holder 220 by displacement of lever 260 by the bobbin butt.

Other forms of automatically rethreading tensioning devices, slub detectors, breakage and exhaustion detectors and tensioning devices may, of course, be substituted for the described devices. For example, referring now to Figs. 11, 12 and 13, the directing support 230 may be provided with wire pivots 270 on opposite sides of the directing support, and upon these and working through vertical slots in the support 230 there may be provided pairs of symmetrical two-part levers 271 and 272, preferably provided with attached wire tension elements 273, 274, which may comprise electrically welded U-staples conjoining forks, which forks may terminate as shown in Fig. 13 in guide ends 275, 275 extending beyond the space defined by the bottom end of the directing support 230. Attached to the upper surface of the tension levers 271, 272, respectively, there may be provided chisel-edged slub-catching plates 276, preferably one of shorter radius to its pivot 270 than the other.

The outward ends of the tension levers 271, 272, are respectively provided with counterweights 277. Upon dropping a full bobbin through the device, the impact of the bobbin butt is received by the slub-catching plates 276 and the device opens to pass the incoming bobbin, as shown in Fig. 12, and thereafter closes against the yarn. Upon occurrence of a slub the chisel-edged plates 226 upon encounter with the slub move against and nip the yarn. There is freedom of motion for the grid elements 273, 274 to approach each other more closely than at normal running position, and this slight motion is utilized to stop winding through the agency of one of the counterweights 277, a wire lever 280 pivoted on a wire arm 281 and connected by link 282 to a lever 283 bearing on the link connection 248 to the winding package stop motion above described.

If the yarn should break or exhaust below the grids 273, 274, the grids also approach each other and work the lever 280 to actuate the stop motion through the link 248.

Unwinding package replenishing devices.—It will be understood that in the operation of the machine so far as described, each of the cheeses being wound on a carrier on the spindle 26 normally receives an accretion represented by the length of the yarn on one supply bobbin during one circulation counterclockwise about the machine, as shown in Fig. 1. Depending on the size of a normal supply package the completed cheese will necessarily contain many lengths represented by the contents of one supply package, and one of the objects of this invention is to enable the machine automatically to go on winding from a replenishment supply automatically united to the spent end of the yarn of the last bobbin wound on a cheese.

It is therefore preferred to provide the machine with devices adapted to deliver a fresh bobbin into the unwinding holders 220 at passage by the right-hand end of the machine as shown in Fig. 1; to detain the leading end of the fresh supply; to find the following end of the exhausted supply extending from the partially wound cheese, to bring these two ends together and unite them, preferably by tying them together; and to do this during the time when the carriers 10 are passing around the end of the machine between the right-hand end of the tractor roll 50 and the right-hand end of the tractor roll 51. It has been explained above how a full cheese is doffed and a replenishment core placed upon the winding spindle. But many of the winding spindles are not elevated to doff their cheeses because the automatic devices above described for discovering a full cheese by measuring its diameter can not operate unless the cheese is full, and therefore the new cores and partially wound cheeses on the spindles 26 of the carriers 10 will come around the end of the machine in normal position, lifted only sufficiently far to cause the latch lever 105 to hold the slide 27 in intermediate elevated position.

It is therefore provided that any newly placed core or partially wound cheese passing around the end of the machine in this position may meet and travel with a movable element of replenishment devices adapted to travel with the carriers 10 through a sufficient reciprocal arc and then to return to deal with the following partially wound cheese. These replenishment devices may and preferably do comprise devices for feeding full new bobbins from the bobbin supply mechanism; devices for finding and detaining the leading end from these bobbins; devices for finding the end on the partly wound cheese, and devices for assembling and tying together these two ends; and finally, devices for delivering the tied-in replenishment bobbin through the directing support 230 into the unwinding holders 220. Thereafter the prepared unwinding and winding pairs go into operation by letting down the winding spindle 26 to contact with the roll 51, and by resetting the stop motion devices mentioned above.

But it will be understood that the machine will operate satisfactorily without the stop motion devices described and especially in such cases as when it is intended to inspect the yarn on the wound cheeses for slubs before using it, and the stop motion devices may then be dispensed with to no disadvantage except such as may follow from idle winding at pairs where the yarn has broken keyed at 349 to the boss 302 of the frame 300 and which plate 348 therefore partakes of the reciprocatory motion of the frame 300. On the under side of the plate 349 a spring pawl 350 drives the ratchet 347 and the gearing 346, 345, 344, 343 and sprocket 342 at an increased rate on the forward stroke of the frame 300. The sprockets 340 and 342 are connected by a chain 351.

Integral with the sprocket 340 a bevel gear 352 meshes with a bevel pinion 353, Fig. 31, on a short transverse shaft 354 provided with a sprocket 355 driving a chain 356 and a sprocket on the transverse driving shaft 308. The shaft 308 is a timing or cam shaft actuating the several parts of the replenishing mechanism.

The frame 300 carries mechanism supported in an upper pivoted extension 361 of casing 305 having legs 362 carried within the upper end of the casing 305 and pivoted, for limited motion in the plane of Fig. 30, on the shaft 360. One of the legs 362 is provided with an arm 363 carrying an anti-friction roller 364 resting on the periphery of a cam 366 fast on the shaft 308. A spring 367 urges the upper end of the extension 361 toward the path of travel of the partially wound cheeses going around the end of the machine.

The forward and back motions of the extension 361 correspond to cycles of operation of end-finding and knot-tying devices, which devices and their support 361 are hereinafter for convenience referred to as the tying-in head.

The extension 361 preferably carries some form of pulling-off and holding device for the loose yarn ends of the winding cheese and the unwinding bobbin. As shown this may comprise an electrically driven fan of the vacuum-cleaner type shown at 370 having a laterally elongated suction nozzle at 371. Energy for the electric motor is provided through flexible conductors 372 from any convenient source, not shown.

The shaft 360 may be utilized as a cam shaft for determining the operation of the knot-tying devices, and a transmission shaft for the rotation of end-finding devices, and for this purpose may be driven through sprockets attached to the shaft 308 and the shaft 360 by a sprocket chain 375. Transmission of power required for rotating devices in the tying-in head is preferably through a grooved pulley 376 on shaft 360 and round belt 377 driving a counter shaft 378, Figs. 34 to 40.

The bobbin positioning and feeding means.—Referring to Figs. 42, 43 and 44, the bobbin magazine 310 carried by the extension 385 of the standard 309 may be of any preferred type holding a sufficient number of wound unwinding carriers to serve the purpose of the machine; or, not shown, the magazine 310 may be itself fed from a larger source of supply bobbins. Preferably, see Fig. 1, the bobbins are held so as to feed downward by gravity into horizontal position lying transverse of the principal longitudinal axis of the machine, see Fig. 1, and for that purpose the extension 385 of the standard 309 may comprise a plate 386 riveted to the back of a suitable sheet metal container used for the magazine 310, said container having any suitable releasing means for the bottommost bobbin B. Preferably on the left or rear face of the magazine 310 a spring held rock shaft 387 in lugs 388 attached to the magazine is provided with rockers 389, 389 at each end, said rockers each having upper and lower detents respectively 390 and 391, the upper detents acting through the apertures 392 in the back of the magazine and serving to detain a bobbin one or two removed from the bottom of the magazine against gravity whenever the detents 390 are moved to release the bottommost bobbin. This effect may be aided by a forward bend at 393 in the bobbin magazine.

The rock shaft 387 is normally positioned by its spring 394 to hold the lowermost detents 390 in operative position. The shaft 387 may be rocked against the spring 394 to release the lowermost bobbin and insert the detents 391 to operative position by a bunter arm 395 having a lower end 396 positioned and adapted to be struck by some part of the reciprocating carriage moving with the frame 300. As shown the back face of the casing 305, comprised of the upper end of the chute 312 preferably serves this purpose. Motion of the frame 300 about the center of shaft 38 causes the chute 312 to come into alignment at the end of the stroke of reciprocation counterclockwise in Fig. 1 with the lower end of the magazine 310, see Figs. 30, 43.

At the top of the support 306 the chute 312 (which may be provided, Fig. 30, with a longitudinal slot 312^a extending its full length on its rear face as viewed in Fig. 31) is extended horizontally at 400 to form a way for a reciprocating supply bobbin carrier device 401 best shown in Figs. 34 to 37 inclusive and comprising a cylindrical structure having an interior bridge at 402 bored and threaded for a driver pintle 403 which projects forwardly of Fig. 31 through a horizontal slot 404, and is embraced outside of the way 400 by a slot 405 in the upper end of a driver lever 406 pivoted to the casing 306 at 407 and having a roll 409 taking into the cam groove of a barrel cam 410 fast on the shaft 308, which, as above described, is among the devices operated by the chain 351 during the forward stroke of reciprocation of the frame 300 and its attachments. The positions of the cam 410, the lever 406 and the remaining parts are such as to secure that the bobbin carrier 401 is to the right in the position of Figs. 31 and 34 at the end of the reciprocating stroke of the frame 300 and casing 305 and support 306.

In an internal bore of the bobbin carrier 401 a rotatable sleeve 412 having an annular groove 413 is held for rotation by a ring segment 414. On the transverse bearing pin 415 in the sleeve 412 a split bobbin carrier device 416, 416 is normally held open by the reaction of a compression spring 417. But the tapered normally open jaws of the bobbin carrier 416 are normally not so far apart as not to enter the central bore of a properly positioned bobbin B. Nevertheless a bobbin entered by the jaws 416 forced together by the bore of the bobbin, is frictionally held by the jaws 416 and spring 417 so as to be capable of reciprocatory movement and rotation with the rotatable sleeve 412.

Referring now to Fig. 43, whenever the bunter 396 is struck by the rear portion of the chute 312 at the top of the support 306, one of the bobbins B is delivered by gravity into the top portion of the chute 312 and into line with the way 400 for the bobbin carrier 401. The bobbin so fed out of the magazine 310 is positioned with its central bore in alignment with the split carrier device 416, 416 by a pivoted support made as a spoon 420 having an up-turned end piece or gate 421 and carried by and adapted to rock with the rock shaft 422, Fig. 43, Fig. 32, having a bearing along the back surface of the way 400, see Figs. 32, 34, 35, 36 and 43. Referring to Figs. 32, 35 and 36, rock shaft 422 is provided with an arm 423 actuated by a vertical rod 424 sliding in bearings 425 forming a part of the support 306 and normally held down by spring 427. The lower end of the arm 424 is bent forward to pass through an aperture 428 in the support 306 and provided at its lower end with an anti-friction roller 429, Figs. 31 and 32, contacting with a disk cam 430 on the shaft 308.

Unless and until the spoon 420 and detent gate 421 are moved out of the way by the operation of the rock shaft 422 and rod 424, a bobbin gravity-delivered in line with the way 400 and in the upper part of the chute 312 remains in that position and is carried with the casing 305, support 306 and the frame 300 on its back or idle stroke. But so soon as the shaft 308 is actuated the bobbin carrier 401 enters the bore in the bobbin B and gate 421 is lowered after this entrance and the carrier 401 and the bobbin are moved forward in respect to the head 361 into the position shown in Fig. 35, the head 361 at this time being at the right hand end of its oscillatory movement on the axis 360 as viewed in Fig. 30 and Fig. 39. This motion preferably occurs during a part of the forward stroke of the frame 300 and after the head 361 has been positioned in juxtaposition to and with some of its carried devices operating in respect to a core tube 147 or a partly wound cheese carried by one of the spindles 26 of one of the carriers 10. Assuming for the moment that operations described below have taken place, the carrier 401 after operations have been performed on the leading end of the yarn of the bobbin carried by it will be retracted to the position shown in Fig. 34, and during the last part of this retraction the bobbin B will be stripped from the carrier 401 and split spindle 416 by a detent 435 pivoted at 436 to the under side of the extension 400 and operated at the proper time to enter between the sleeve 412 and the head of the bobbin by the spring pressed thrust rod 437 cranked forward through the aperture 428 and having at its lower end an anti-friction roll 439 cooperating with the cam 440 on the shaft 308. It will be observed that the bobbin carrier 401 makes a stroke to the left during the operative cycle of the replenishing devices, positions its carried bobbin for rotation in respect to the head 361 in about the position shown in Fig. 35 and in Fig. 39, and thereafter retires to the position of Fig. 34, the bobbin B being stripped from the carrier 401 and dropped down the chute 312, the gate 420 being open.

The leading end of the yarn from this bobbin so dropped has been tied to the following end of the cheese or the starting wind on a bobbin tube 147, and the tied run of yarn passes out of chute 412 through slot 312^a.

This operation is accomplished as follows:

The end finding and tying devices.—Referring now more particularly to Figs. 30, 31, 34 to 41 inclusive, and the timing diagram Fig. 49, it has been explained that the head 361 oscillates about the shaft 38 as a center with the frame 300, and also oscillates about the horizontal shaft 360 in the radial plane of the shaft 38. When the head 361 moves to the left as shown in Figs. 2, 30 and 38 to 41 in respect to the carriers 10 and the cheese C or core 147 carried by the carriers 10, there is no lateral relative motion between the carriers 10 and the head 361, since the oscillating motion about the center of the shaft 38 is at the same rate as the progressive motion of the carriers 10 and the winding tube or winding package carried thereby. There is therefore an interval of travel, which may be as much as 50° of arc, while the winding carriers are going about the end of the machine on which the replenishment devices including the head 361 travel with the winding package or a core or tube for a winding package. During this travel the machine performs the operations of finding the exhausted or broken end of the surface of the winding package (or the end of a preliminary winding on the tube or carrier for the wound package); gripping this end; carrying this end away beneath the locus of motion of the bobbin B into and in front of the head 361, finding and gripping the end of the new yarn on the bobbin B, assembling the new yarn on the exhaust end from the winding package in the same vertical plane; tying these ends together and cutting off the surplus ends of the yarn; stripping the tied knot and releasing the tied ends; and, as above described, placing the replenishment bobbin whose yarn is now tied to the exhausted end in the winding holder 220 appropriate to the winding package.

The devices for the above purposes may be any competent devices for performing these operations, or they may be replaced or substituted for by any device capable of performing the operation of uniting the broken or exhausted end going to the winding package and the leading end of the unwinding package. For example, it is within the purview of this invention to stop the winding package by the means above described or other means upon the breakage or exhaustion of the yarn being wound and to leave the unwound end of the exhausted or broken yarn in position to be conjoined to the unwound end of a supply bobbin, by knotting or otherwise, of a new supply bobbin fed to an unwinding carrier such as one of the unwinding holders220by so much of the above-described mechanism as it is desirable to use for this purpose. It is within the invention to merely approach and position these two ends and to obtain the advantages of the remaining automatic apparatus by depending upon an operator stationed at the end of the machine to tie these ends together by the operation of a hand knotter, or otherwise. It will therefore be understood that the end-finding, holding and tying devices about to be described are instances only of automatic devices for this purpose and that it is not essential to the operation of the machine that any such devices should be employed or that the particular devices about to be described should be employed.

Assume now that the frame 300 has begun a forward motion (counterclockwise in respect to Fig. 1), the head 361 is then central on the same radial plane of the shaft 38 as the carrier 10, the spindle 26 and axis of the core tube 147 (which may have only the starting winding but may carry a partially completed cheese C) being parallel with the axis of the shaft 378 in the head 361; this relation continues throughout motion of frame 300.

Referring now to Figs. 30, 34 and 38, head 361 oscillates forward toward the elevated and stationary winding package by the operation of the cam 366 and spring 367 until contact takes place between the surface of the winding package or its carrier 147 and devices carried by the head 361.

Preferably these devices are a friction drive roll 450 on a stud shaft 451 having shoulder 452 adapted to take into a sector slot 453 of a lever 454 for relative motion in the sector slot 453 against a spring 455. Lever 454 is attached to a crank arm and sleeve 458, the sleeve being bored for a transverse shaft 456 having a bearing in the head 361. The sleeve and arm 458 are adapted to be rocked by a link 459 extending downwardly through the head 361, see Figs. 31, 33, and terminating at the bottom in an enlargement 468 slotted at 461 to take over the shaft 360 and provided with an anti-friction roller 462 taking into a cam groove 463 in the cam 464 on shaft 360. By the operation of the cam 464 forward motion of the head 361 is accompanied by downward motion of the tractor roller 450. When the tractor roll bottoms against a tube or carrier 147 or a partially completed cheese C, the shaft 451 can yield against the spring 455.

The roll 450 is driven whenever the parts in the head 361 are actuated by a belt 466 on a pulley 467 on the shaft 456 which is driven by a pulley 468 and cross belt 469 and pulley 470 on the shaft 378.

The roll 450 may be covered with rubber and is operated by its belt 466 to drive the cheese or tube 147 with which it is in contact in a direction to unwind.

The surface of the cheese or the pre-winding on the roll 147 is swept during this motion induced by the roller 450 by a brush roll 475 on a transverse shaft 476 of the forward extension 457 of the head 361. This brush ~~roll is driven by the pulley 477, belt 478~~ and pulley 479 on the shaft 478. The line of motion of the center of rotation at 476 of the brush 475 is toward and from the position of the axis 26 upon which the winding package rotates and the surface of the brush roll 475 will therefore reach contact with the winding package whatever its attained diameter may be.

The operation of the brush roll 475 is to lift from its attachments to the winding package the exhausted or broken end. The nozzle 371 of the suction apparatus 370 is at the delivery side of the brush and the released end enters the nozzle 371 and is competently held for subsequent operations.

Referring now to Fig. 38, the head 361 backs off under the operation of the cam 366 for the next step to the position of Fig. 39. This is the position in which the bobbin carrier 401, Figs. 34 to 37, becomes active to advance the new bobbin B to the position shown in Fig. 35 and Fig. 39. The roll 450 has meanwhile been retained in a lowered position by the operation of lever 454, and its actuating cam 464, Fig. 33, yielding against spring 455 to pass over the bobbin B and to contact with and drive the bobbin B in a direction to unwind its yarn. This takes place while the surface of the unwinding package B is in contact with the brush roll

475, with the result that the leading end of the unwinding package is taken in by the suction nozzle 371, which now holds both ends.

Referring now to Fig. 40, the head 361 backs off further to the position shown in said figure by the operation of the high part of the cam 366.

The forward extension 457 of the head 361 carries instrumentalities for assembling the two yarns in the same radial plane of the shaft 38, preferably about centrally of the length of the winding and unwinding packages, now positioned as shown in Fig. 40 and both stationary, except as they may be rotated by the unwinding of their yarns held by the suction nozzle 371. These assembling means preferably include upper and lower jaw-clamp members 480 and 481 respectively, of which the upper member carries a yarn positioning fork having right and left members 482 and 483 respectively, see Figs. 34 to 36 and 38 to 41. The clamp jaw members 480, 481 may be central on shouldered pivot screws 484 and 485 respectively, and said jaws are embodied in toothed sectors 486, 487 respectively in mesh with the other. The sector 487 may have an arm for shouldered pivot screw 488 to which is connected a link 489, see Figs. 30 and 31, also held downwardly by a spring 490 to bring an anti-friction roll 491 at the end of the link 489 against the periphery of the actuating cam 491 on the left-hand end of the shaft 360 as viewed in Fig. 31. The operation of the cam 492 is such as to close the jaws 480, 481 into the position shown in Fig. 40 and Fig. 36 at the stage of the operation represented by Fig. 40.

The operation of the positioning fork 482, 483 is such as to bring the assembled and clamped ends into the central plane as will be obvious from inspection of Figs. 36 and 40. The free ends of the assembled yarns in this position extend past the tying bill or the active knot forming element of a knot tying device 500, Figs. 36 to 47 inclusive.

The knot tying mechanism.—Preferably as best shown in Fig. 36 the tying bill 501 (which may be of familiar type shown enlarged partly in section in Fig. 48, having a cutter and clamp member 502 adapted to cut the yarns between the member 502 and a cutting jaw 503 and clamp the yarns severed near their ends between one face of the member 502 and another jaw 504 of the knotting bill) is carried by a bearing sleeve 505 mounted on a radius arm 506 (Fig. 36) central on the right-hand end of the shaft 476 as viewed in Fig. 34.

Pivoted jaw 502 may be worked by a barrel cam (not shown) at the end of the sleeve 505 carried by the radius arm 506. The shaft 507 and sleeve 505 are long enough to bring the knotter bill 501 to the central plane in which the yarns are held by the devices above described.

In order to tie a seamstress' knot of two yarns by the usual operation of the bill 501 the yarns are first laid in the crook of the bill. This may be accomplished by the proper motion of the knotter about the shaft 476 into contact with the positions of the yarns. Thereafter the knotter bill is turned one and one-quarter revolutions, which completes the formation of the knot on the bill and cuts the free ends of the yarns. The knotted yarn ends are then pulled out of the jaws 503, 504, and the knot set up by this pull. In the present instance this set-up and knot-stripping motion is secured by the proper motion of the knotter in relation to the clamp 480, 481 after it shall have rotated one and one-quarter revolutions to form the knot.

Referring to Figs. 45, 46 and 47, particularly, the rotative motions of the tying bill 501 are preferably secured by cooperation between the radius arm 506 and a concentric sector 510 having teeth meshing with the pinion 508, having a bearing boss 511 bored to bear on the shaft 476, and connected to the radius arm 506 by a pin 512, spring 513 and pin 514, on the radius arm 506 and taking through sector slot 515 in sector 510. Sector 510 is the driver for the radius arm 506, and relative motions between the radius arm 506 and the sector 510 serve to actuate the tying bill shaft 507. The sector 510 is operated by a shouldered pivot screw 517 taking over a link 518, in turn pivoted at 519 to an arm 520 rigid with the lever 454 upon which the tractor roll 450 is mounted, and therefore adapted to be moved when the sleeve and arm 458, Fig. 34, are operated by the link 459; all of these parts rocking about the shaft 456, as above explained.

Referring now to Fig. 33, the cam 464 operating the link 459 thrusts upwardly on this link to position operatively the tractor roll 450. These movements rock the knotter driver sector 510 idly. But the cam track 463 comprises a slope adapted to pull down on the link 459, and this moves the parts consecutively from the position of Fig. 45 to the position of Figs. 46 and 47, and thereafter restores the parts to the position of Fig. 45.

In order first to position the tying bill 501 in relation to the yarns to be knotted and then to tie the knot by turning the shaft 507, a stop pin 525, fast in one of the walls of the head 361, encounters the radius arm 506 and stops its movement with the driver sector 510, the spring 513 extending, as shown in Fig. 47, to permit relative movement of the sector 510 to rotate the shaft 507. This is the operative rotation of the tying bill; during it the convolution of the knot is formed on the bill, the waste ends severed (and removed by the suction device 71), and the severed ends held by the bill 501.

To set up the knot it is preferred to rely upon the bodily movement away from its operative position of the tying bill, which takes place in respect to the closed clamps 480, 481, before these are opened by upward motion of the link 489. For this purpose one preferred means comprises a sector slot 526 in the driver sector 510 into which takes a locking pin 527 on the radius arm 506. On the face of sector 510 a bell crank latch lever 528 having a notched end is held by a light spring 529 to engage the pin 527 at the extreme of the relative movements of radius arm 506 and driver sector 510, Fig. 47. Pin 525 is in the path of movement of the cam lug 530 projecting toward the pin 525 from the tail 531 of the latch lever 528. On the return motion of the parts the lug 530 reacts with the pin 525 to lift the latch 528 from the pin 527 and thus to restore the parts to their starting position, shown in Fig. 45. The retreating motion downwardly and outwardly of the shaft 507 and tying bill 501 sets and strips the knot. This will be clear from inspection of Fig. 41, which shows the parts in their final position.

The frame 300 and its attachments now returns to repeat the functions of its carried devices in respect to another partially wound cheese or new core 147, whichever may be on the next carrier 10. It will be understood that a new bobbin B positioned as shown in Fig. 34, returns with the frame 300.

Referring now to Figs. 1, 3, 4 and 5, the unwinding holders 220 having been replenished, the yarns automatically threaded through the tension and stop motion devices, if such are employed, the winding carriers are ready to resume operation, whether the winding package is a mere core with a prewinding or a partially completed cheese. It will be recalled that the carriers 27 are latched in their elevated position by the latch 105 during passage around the end of the machine. The latch levers 105 are now released by contact of their cam ends 142 with the cam 141 and the carriages 27 resume their normal position shown in Figs. 3 and 4, the distance dropped by them depending upon the diameter of the winding on the cores 147.

Referring to Figs. 3 and 4, standing under the portions 142 of the levers 105 and pivoted on the heads 21 are resetting levers 540 each connected by a link 541 to an arm 542 on the stop motion brake 255. The unlocking motion of the cam end at lever 542 and latch 105 resets the lever 255 which is locked in the resetting position by the spring lever 250.

Winding now proceeds until the winding packages have traveled to the left end of the tractor roll 51, Fig. 1. It is desirable to lift the winding cheeses away from the tractor rolls for passage about the left end of the machine. This is done by the operation of a crutch head 97^a on a slide 91^a operated by the cam 80 on the end of the cam shaft 79, these devices operating in the same way as the lever 93 and lever 91, above described, except that it is not here necessary to discriminate between full and partially completed cheeses so that the crutch head 97^a may be a simple projection from the slide 91^a. Carriages 27 are locked in their upper position by the latch levers 105 while going around the left end of the machine and are again unlocked by the cam 141.

The operations of the machine will now be apparent without further description, having been described serially in connection with the agencies of the machine. It will be observed that so long as cores are kept in the magazine 148 and new bobbins B are kept in the magazine 310 the machine is adapted automatically to continue operation without more than casual attendance.

The invention has been described in relation to that kind of winding operation which produces a cylindrical cheese, but it will be observed that the spindles 26 might as well be replaced by cone holding spindles for conical cores positioned on carriages 27 to hold an element of the core surfaces parallel with the tractor rolls 50, 51, whereupon the machine is adapted to wind conical packages without further change except to conformably change the direction of the donning stroke of the core replenishing devices and to provide a core magazine suitable to direct and feed conical cores, and to change the angle of the plane of contact of the end-finding devices to conform to the conical winding. The invention is therefore obviously in respect to these and other modifications and substitutions, independent of the particular constructions shown, except in so far as they may be specifically claimed.

We claim:

1. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, and means having a rotary element traveling with the carrier for traversing the winding yarn.

2. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, an unwinding supply holder traveling with said carrier, and means having a rotary element traveling with the carrier for traversing the winding yarn.

3. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form

a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, means having a rotary element traveling with the carrier for traversing the winding yarn in the same direction during a plurality of revolutions of the winding mass, and in the opposite direction, and driving means for said winding mass and rotary element common to both.

4. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, means for driving the winding mass during travel in the path of motion of the carrier by contact with a rotary driver, and traversing means for the wound yarn adapted to be driven by said rotary driver.

5. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, means for driving the winding mass during travel in the path of motion of the carrier by contact with a rotary driver, traversing means for the wound yarn adapted to be driven by said rotary driver, and means for cessation of driving of said wound mass and such traversing means during travel in parts of said path of motion.

6. In a winding machine having a winding mass driving tractor roller and means for causing a winding and unwinding pair to traverse the length of the roller during winding on the wound mass, yarn-guide traversing means moving with the wound mass and having driving contact with said roller during said motion.

7. In a winding machine having a winding mass driving tractor roller and means for causing a winding and unwinding pair to traverse the length of the roller during winding on the wound mass, yarn-guide traversing means moving with the wound mass and having driving contact with said roller during said motion, and means for causing cessation of driving contact between said winding mass and roller after a predetermined length of traverse in winding contact.

8. In a winding machine having a winding mass driving tractor roller and means for causing a winding and unwinding pair to traverse the length of the roller during winding on the wound mass, yarn-guide traversing means moving with the wound mass and having driving contact with said roller during said motion, and means for causing cessation of operative contact between said yarn-guide traversing means and tractor roller.

9. In a winding machine, having a winding mass driving tractor roller and means for causing a winding and unwinding pair to traverse the length of the roller during winding on the wound mass, yarn-guide traversing means moving with the wound mass and having driving contact with said roller during said motion, and means for causing cessation of driving contact between said winding mass and said yarn-guide traversing means respectively and said roller, each at a predetermined place in said traverse.

10. In a winding machine, having a winding mass driving tractor roller and means for causing a winding and unwinding pair to traverse the length of the roller during winding on the wound mass, yarn-guide traversing means moving with the wound mass and having driving contact with said roller during said motion, and means for supporting the traversing means and the winding package on said carrier severally for motion toward and away from said roller in different directions.

11. In a winding machine, having a winding mass driving tractor roller and means for causing a winding and unwinding pair to traverse the length of the roller during winding on the wound mass, yarn-guide traversing means moving with the wound mass and having driving contact with said roller during said motion, means for supporting the traversing means and the winding package on said carrier severally for motion toward and away from said roller in different directions, and automatically operating devices for causing said motions respectively at different points in the path traversed by said carrier.

12. In a winding machine, in combination, a carrier for winding pairs adapted for travel in respect to driving means for the winding member of said pairs, a rotary yarn-guide traverse cam mounted on said carrier, and means for driving said rotary traverse cam from the driving means for said winding member during travel of said carrier, and during travel of the traverse cam in the direction of its axis of rotation.

13. In a winding machine, in combination, a carrier for winding pairs adapted for travel in respect to driving means for the winding member of said pairs, a rotary yarn-traverse cam and a yarn guide worked by said cam in operative relation with the yarn between members of said unwinding and winding pair, and means for driving said rotary traverse cam from the driving means for said winding member during travel of said carrier in a direction parallel to the motion of said reciprocating yarn guide.

14. In a quick-pitch traverse motion for winding machines, the combination of a laterally movable carrier for winding and unwinding pairs of a tractor roller for driving the winding pair, and a rotary cam on said

carrier having friction members adapted for friction driving and longitudinal sliding contact with said tractor roller.

15. In a quick-pitch traverse motion for winding machines, the combination of a laterally movable carrier for winding and unwinding pairs of a tractor roller for driving the winding pair, and a rotary cam on said carrier having friction members adapted for friction driving and longitudinal sliding contact with said tractor roller, and means for moving said friction member into and out of contact with said tractor roller during lateral motion of said carrier.

16. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, an unwinding supply holder traveling with said carrier, and means for automatically removing unwinding-supply carriers from said holder.

17. A carrier for winding and unwinding pairs adapted for travel in respect to driving means for the winding mass, in combination with an unwinding package holder mounted on said carrier having means adapted to permit discharge of unwinding supply carriers by gravity.

18. A carrier for winding and unwinding pairs adapted to travel in respect to driving means for the winding mass, in combination with an unwinding package holder mounted on said carrier having a swinging detent adapted to permit discharge of unwinding supply carriers by gravity on displacement, and means for displacing said detent by detaining it against motion with said carrier.

19. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, in combination with means on said carrier for holding and discharging an unwinding yarn supply package, and automatic means acting at a point in said predetermined path to replenish said holder with a fresh supply package.

20. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustained headless package by overlapped layers of reversed spiral windings, in combination with means on said carrier for holding and discharging an unwinding yarn supply package adapted to receive a supply package delivered by gravity thereto, and automatic means acting at a point in said predetermined path to replenish said holder by dropping into it a fresh supply package.

21. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, in combination with means on said carrier for holding and discharging an unwinding yarn supply package adapted to receive a supply package delivered thereto, means on said carrier for tensioning the yarn, and automatic means acting at a point in said predetermined path to replenish said holder by placing in it a fresh supply package and means for automatically placing the new yarn in operative relation to the tensioning devices.

22. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, said carriers comprising an unwinding package holder, and a directing device adapted to guide a replenishment supply bobbin or carrier to be dropped into said unwinding holder.

23. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, said carriers comprising an unwinding package holder, and a directing device adapted to guide a replenishment supply bobbin or carrier to be dropped into said unwinding holder, in combination with means for automatically discharging bobbins or carriers from said holder, and means for dropping a replenishment supply package into said directing device.

24. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound sulf-sustaining headless package by overlapped layers of reversed spiral windings, said carriers comprising an unwinding package holder, a traverse guide and means for operating said traverse guide, detector devices bearing on the yarn between said traverse guide and said holder, and means permitting said detector devices to be moved to receive a yarn from a new supply inserted in said holder.

25. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining

headless package by overlapped layers of reversed spiral windings, said carriers comprising an unwinding package holder, a traverse guide and means for operating said traverse guide, tension devices bearing on the yarn between said traverse guide and said holder, said tension devices having freedom of motion to receive a yarn from a new supply moved into said holder past their working position.

26. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, said carriers comprising an unwinding package holder, and a directing device adapted to guide a replenishment supply bobbin or carrier to be dropped into said unwinding holder, in combination with a tension and detector mechanism operating at the position of said directing device, and having yarn contacting devices mounted removably in the path of motion of a replenishment supply into said unwinding holder.

27. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, said carriers comprising an unwinding package holder, and a directing device adapted to guide a replenishment supply bobbin or carrier to be dropped into said unwinding holder, in combination with means adapted to move the winding mass of yarn away from its driving means, a stop for holding said means out of operation, tension mechanism on said carrier, and a connection from said tension mechanism to said means for moving the winding yarn mass adapted to release said stop on undue tension.

28. A winding machine having therein a carrier for moving a winding mass of yarn in a predetermined path, means for winding yarn on the mass during such motion to form a traverse wound self-sustaining headless package by overlapped layers of reversed spiral windings, said carriers comprising an unwinding package holder, and a directing device adapted to guide a replenishment supply bobbin or carrier to be dropped into said unwinding holder, in combination with a tension and slub and breakage detector mechanism operating at the position of said directing device and means for stopping motion of the winding mass on breakage or exhaustion detected by said detector mechanism.

29. In combination, in a winding machine having carriers for winding and unwinding pairs adapted to be circulated about the machine during the winding operation, a breakage or exhaustion detector and a winding package stop motion device carried by each carrier, and means for operating said stop motion devices severally upon detection of breakage or exhaustion by any of said detectors.

30. In combination, in a winding machine having carriers for winding and unwinding pairs adapted to be circulated about the machine during the winding operation, a breakage or exhaustion detector and a winding package stop motion device carried by each carrier, and means for operating said stop motion devices severally upon detection of breakage or exhaustion by any of said detectors, a resetting device for said stop motion, and automatic means having an element relatively fixed in relation to the travel of said carriers for resetting the stop motions preparatory to winding from replenished supplies.

31. In combination, in a winding machine having carriers for winding and unwinding pairs adapted to be circulated about the machine during the winding operation, means operating at a place in the circulatory path of travel of said carriers for automatically detecting a full winding package, and means operated thereby for positioning said package for doffing.

32. In combination, in a winding machine having carriers for winding and unwinding pairs adapted to be circulated about the machine during the winding operation, means operating at a place in the circulatory path of travel of said carriers for automatically detecting a full winding package, means operated thereby for positioning said package for doffing, and means operating to doff said positioned package.

33. In combination in a winding machine having carriers for winding and unwinding pairs adapted to be circulated about the machine during the winding operation, doffing means comprising a pusher adapted to act on full packages displaced in relation to their winding supports, and means for measuring the diameter of the packages and displacing full packages into relation with the pusher.

34. In combination, in a winding machine having means for circulating winding pairs, supply package holders, means to release spent supply packages for discharge by gravity from the holders operating at a place in the path of circulation, and a conveyor receiving spent supply packages dropped therefrom.

35. In combination, in a winding machine having means for circulating winding pairs, a winding spindle for each winding package, full package doffing means operating to remove a full package from its spindle and release said package at a place in the path

of circulation, and a conveyor receiving full packages dropped by gravity therefrom.

36. In combination, in a winding machine having means for circulating winding pairs, a spindle for supporting the winding package, means for doffing full packages from the spindles, and devices operating as a consequence of the removal of the full package for placing a carrier for another winding package on said spindle.

37. In combination in a winding machine having carriers for winding and unwinding pairs adapted to be circulated about the machine during the winding operation, winding package spindles on said carriers, means for latching said spindles in position to doff a full package, a winding core magazine and core feeding means positioned in relation to the path of travel of said carriers, and normally restrained means for placing a core on a passing spindle adapted to be operated by a doffer package.

38. In winding core feeding and applying mechanism for a circulatory-winding-pair winding machine, the combination of a motor device energized by connections to the winding machine and of a core magazine and core placing devices operated by the motor, with a restraining detent released by passage of a doffed package.

39. An automatic winding machine of the kind having carriers for circulating winding yarn packages and unwinding supply packages in relation to devices for driving the winding packages and adapted successively to move the carriers along rotary winding package drivers, having devices operating at that part of the path of circulation between successive passages along the winding mass drivers for replenishing the winding supply.

40. An automatic winding machine of the kind having carriers for circulating winding yarn packages and unwinding supply packages in relation to devices for driving the winding packages and adapted successively to move the carriers along rotary winding package drivers, having means operating at that part of the path of circulation between successive passages along the winding mass drivers to unite the following end of the winding yarn on a winding package to the leading end of a replenishment unwinding supply package, for replenishing the winding supply.

41. An automatic winding machine of the kind having carriers for circulating winding yard packages and unwinding supply packages in relation to devices for driving the winding packages and adapted successively to move the carriers along rotary winding package drivers, having means operating at that part of the path of circulation between successive passages along the winding mass drivers to unite the following end of the winding yarn on a winding package to the leading end of a replenishment unwinding supply package, and means for delivering said replenishment package to a holder circulating with the carrier for the winding package, for replenishing the winding supply.

42. An automatic winding machine of the kind having carriers for circulating winding yarn packages and unwinding supply packages in relation to devices for driving the winding packages and adapted successively to move the carriers along rotary winding package tractor rolls, having devices operating at that part of the path of circulation between successive passages along the winding mass tractor rolls to tie together the following end of the winding yarn on a winding package and the leading end of a replenishment unwinding supply package.

43. An automatic winding machine of the kind having a carrier adapted to move a winding package in a circulatory path in the direction of the axis of rotation of the winding package and successively to bring the surface of the winding package into sliding and rotative driving contact with each of a plurality of tractor rolls, having means operating during passage of the carrier from one to the other of said tractor rolls to deliver to the carrier a replenishment unwinding supply.

44. An automatic winding machine of the kind having a carrier adapted to move a winding package in a circulatory path in the direction of the axis of rotation of the winding package and successively to bring the surface of the winding package into sliding and rotative driving contact with each of a plurality of tractor rolls, having means operating during passage of the carrier from one to the other of said tractor rolls to deliver to the carrier a replenishment unwinding supply, and means operating during said passage to assemble and knot together the following end of the yarn wound on the winding package and the leading end on the replenishment supply.

45. An automatic winding machine having therein, in combination with traveling carriers for winding and unwinding supply packages, a relatively stationary magazine for replenishment supply packages, means traveling with the carriers for a limited distance to receive a supply package from the magazine, and means for delivering supply packages to said carriers during travel together of said means.

46. An automatic winding machine having therein, in combination with traveling carriers for winding and unwinding supply packages, a relatively stationary magazine for replenishment supply packages, and means adapted to travel with each of said carriers for a limited distance for delivering

supply packages to said carriers during their passage by said means.

47. An automatic winding machine having therein, in combination with traveling carriers for winding and unwinding supply packages, means for discharging spent supply packages from the moving carriers, a relatively stationary magazine for replenishment supply packages, and means traveling with the carriers for receiving supply packages from the magazine and delivering supply packages to said carriers during their travel.

48. A winding machine adapted to wind headless self-sustaining traverse wound packages during circulation of a carrier for an unwinding and a winding package about the machine, having devices for suspending winding motion of the winding package during a part of its circulatory travel, in combination with an unwinding holder traveling with the winding package, and devices traveling with the carrier and operating during said suspension of winding motion to unwind the leading end of a replenishment unwinding supply package and place said replenishment package in said holder.

49. A winding machine adapted to wind headless self-sustaining traverse wound packages during circulation of a carrier for an unwinding and a winding package about the machine, having devices for suspending winding motion of the winding package during a part of its circulatory travel, in combination with means for assembling the end of the yarn on said winding packages with the leading end of the yarn of a replenishment unwinding package to enable these ends to be tied together, in combination with means for removing the tied-in replenishment package after tying to a holder therefor traveling with said carrier, and means for resuming winding motion.

50. Replenishing devices for winding machines having circulatory winding pair carriers having in combination a supply package receiving device adapted to travel with a carrier during motion in one direction in a reciprocatory path, an unwinding supply magazine adapted to load a supply package to said receiving device at one end of its motion, means acting on a subsequent motion of said receiving device to deliver the supply package to one of said carriers.

51. A winding machine having means for winding packages circulating about the machine on carriers, in combination with means for circulating the carriers, a frame adapted to carry devices for delivering replenishment supply packages to the carriers, and means for locking said frame to driving means moving with said carriers during a predetermined travel of the carriers, and means for unlocking and retracting said frame.

52. A winding machine having means for winding packages circulating about the machine on carriers, in combination with means for circulating the carriers, a frame adapted to carry devices for delivering replenishment supply packages to the carriers, driving means for said delivering devices actuated upon motion of said frame in one direction, and means for locking said frame to driving means moving with said carriers during a predetermined travel of the carriers, and means for unlocking and retracting said frame.

53. A winding machine having means for winding packages circulating about the machine on carriers, in combination with means for circulating the carriers, a frame adapted to carry devices for delivering replenishment supply packages to the carriers and devices for assembling and tying together ends of yarn from the winding package and a replenishment unwinding package, means for locking said frame to driving means moving with said carriers during a predetermined travel of the carriers, and means for unlocking and retracting said frame.

54. A winding machine having means for winding packages circulating about the machine on carriers, in combination with means for circulating the carriers, a frame adapted to carry devices for delivering replenishment supply packages to the carriers, and driving means for said assembling and tying devices actuated upon motion of said frame in one direction, means for locking said frame to driving means moving with said carriers during a predetermined travel of the carriers, and means for unlocking and retracting said frame.

55. A winding machine having means for winding packages circulating about the machine on carriers, in combination with means for circulating the carriers, a frame adapted to carry a knot-tying head, means for coupling said frame to and releasing it from a part moving with one of the carriers, means for retracting the frame after motion with the carriers, and means for moving the knot-tying head toward and away from a winding package on said carrier in stages consequent upon motion of said frame with said carrier.

56. A winding machine having means for winding packages circulating about the machine on carriers, in combination with means for circulating the carriers, a frame adapted to carry a knot-tying head, means for coupling said frame to and releasing it from a part moving with one of the carriers, means for retracting the frame after motion with the carriers, and means for moving the knot-tying head toward and away from a winding package on said carrier in stages consequent upon motion of said frame with said carrier, and means in said knot-tying head for operating upon the yarns of said winding pack-

age and a replenishment package to assemble and tie them together during motion of the frame and carrier in coupled relation.

57. A winding machine having means for winding packages circulating about the machine on carriers, in combination with means for circulating the carriers, a frame adapted to carry a knotter head, means for coupling said frame to and releasing it from a part moving with one of the carriers, means for retracting the frame after motion with the carriers, and means for moving the knot-tying head toward and away from a winding package on said carrier in stages consequent upon motion of said frame with said carrier and corresponding to seizing the end of the winding-package yarn, seizing the end of the replenishment supply yarn, assembling the ends, and tying and stripping a knot in the assembled ends.

58. The combination with a circulating carrier for winding and unwinding pairs and means for circulating said carrier of a replenishment unwinding supply magazine, a frame for a knotter head adapted to be coupled to a part moving with said carrier and uncoupled therefrom, yarn-end assembling and knot-tying devices on said frame movable toward and away from said carrier and means on said frame for positioning a replenishment supply package and the winding package on said carrier in position for their yarns to be acted upon successively by said assembling and tying devices during motion of said devices away from said carrier.

59. Replenishing mechanism for winders having therein in combination, an assembling and tying device having yarn clamping jaws, means, cooperating with said jaws, for assembling yarn ends between them in substantially the same position, and a tying bill adapted to be moved into operative contact with the assembled yarns.

60. Replenishing mechanism for winders having therein in combination, an assembling and tying device having yarn clamping jaws, means, cooperating with said jaws, for assembling yarn ends between them in substantially the same position, a tying bill adapted to be moved into operative contact with the assembled yarns, means for rotating said tying bill to form a knot, and means for setting and stripping said knot.

61. Replenishing mechanism for winders having therein in combination, an assembling and tying device having yarn clamping jaws, means, cooperating with said jaws, for sweeping laterally yarn ends between them into substantially the same central plane, and a tying bill adapted to be moved into operative contact with the assembled yarns by motion in said plane.

62. Replenishing mechanism for winders having therein in combination, an assembling and tying device having yarn clamping jaws, means, cooperating with said jaws, for assembling yarn ends between them in substantially the same position, a tying bill adapted to be moved into operative contact with the assembled yarns, means for rotating said tying bill to form a knot, and means for moving the tying bill away from the clamp to set and strip said knot.

63. Replenishing mechanism for a yarn handling machine having therein in combination means for assembling yarn ends to be united, means for clamping the assembled ends, a knot-tying device adapted to be moved in a reciprocal path toward and from the place of the assembled ends, and means for causing the knot-tying device to be actuated when positioned at one end of its path of motion to form the convolutions of a knot in said yarn ends.

64. Replenishing mechanism for a yarn handling machine having therein in combination means for assembling yarn ends to be united, means for clamping the assembled ends, a knot-tying device adapted to be moved in a reciprocal path toward and from the place of the assembled ends, means for causing the knot-tying device to be actuated when positioned at one end of its path of motion to form the convolutions of a knot in said yarn ends and means for moving the knot-tying device away from said clamping device in its path of motion for setting up and stripping the knotted ends from said tying device.

65. A knot-tying device having a shaft and tying bill thereon mounted for reciprocal motion toward and from the place of action of the tying bill to tie, in combination with an actuator therefor adapted to be moved in a longer reciprocal path to a greater extent than the tying bill shaft, a rack on the actuator engaging a pinion on the tying bill shaft, yielding means normally causing motion together of the actuator and tying bill shaft, and a stop determining the end of motion of said tying bill shaft in its path, whereby further motion of the actuator causes rotary tying movement of the operatively positioned tying bill.

66. A knot-tying device having a shaft and tying bill thereon mounted for reciprocal motion toward and from the place of action of the tying bill to tie, in combination with an actuator therefor adapted to be moved in a longer reciprocal path to a greater extent than the tying bill shaft, yielding means normally causing motion together of the actuator and tying bill shaft, and a stop determining the end of motion of said tying bill shaft in its path, whereby further motion of the actuator causes rotary tying movement of the operatively positioned tying bill, and means for locking the actuator and tying bill together during a part of return reciprocal motion, for the purpose of setting and stripping a knot by motion of the rotatively

stationary tying bill away from its place of operation.

67. In a knot-tying device, a radius arm having a bearing therein for a tying bill shaft at an angle to its plane of motion, a tying bill shaft in said bearing, a pinion on said shaft, an actuator sector concentric with said radius arm having a segmental rack thereon engaging said pinion, a spring device normally holding said arm and sector in relatively fixed relation, means to rock said actuator sector to move said tying bill toward and away from a position for its operation, and a stop on a fixed part predetermining a limit of motion for said radius arm, said actuating sector having freedom for further motion to rotate said tying bill shaft.

68. In a knot tying device, a radius arm having a bearing therein for a tying bill shaft at an angle to its plane of motion, a tying bill shaft in said bearing, a pinion on said shaft, an actuator sector concentric with said radius arm having a segmental rack thereon engaging said pinion, a spring device normally holding said arm and sector in relatively fixed relation, means to rock said actuator sector to move said tying bill toward and away from a position for its operation, and a stop on a fixed part predetermining a limit of motion for said radius arm, said actuating sector having freedom for further motion to rotate said tying bill shaft, means for locking said sector and radius arm together after a predetermined rotation of said tying bill, and means to release said locking means during a return oscillation of said sector and arm.

69. In a replenishing mechanism for winding machines, the combination of a magazine for yarn supplies with feeding means adapted to move a yarn supply package from the magazine, means for supporting the supply package for rotation in its advanced position, a tying head bearing therein unwinding devices operative on a winding package and on said advanced supply package successively, and means for moving said unwinding means successively first into contact with one of said yarn packages and then into contact with the other.

70. In a replenishing mechanism for winding machine, the combination of a magazine for yarn supplies with feeding means adapted to move a bobbin from the magazine, means for supporting the bobbin for rotation in its advanced position, a tying head having therein unwinding devices operative on a winding package and on said advanced bobbin successively, and means for moving said unwinding means successively from contact with the winding package to contact with said advanced bobbin, end holding devices on said tying head, and assembling devices adapted to juxtapose the respective unwound ends.

71. In a replenishing mechanism for winding machine, the combination of a magazine for yarn supplies with feeding means adapted to move a bobbin from the magazine, means for supporting the bobbin for rotation in its advanced position, a tying head having therein unwinding devices operative on a winding package and on said advanced bobbin successively, and means for moving said unwinding means successively from contact with the winding package to contact with said advanced bobbin, end holding devices on said tying head, assembling devices adapted to juxtapose the respective unwound ends and tying devices for tying together the juxtaposed ends.

Signed by us at Wilton, New Hampshire, this fourth day of December, 1926.

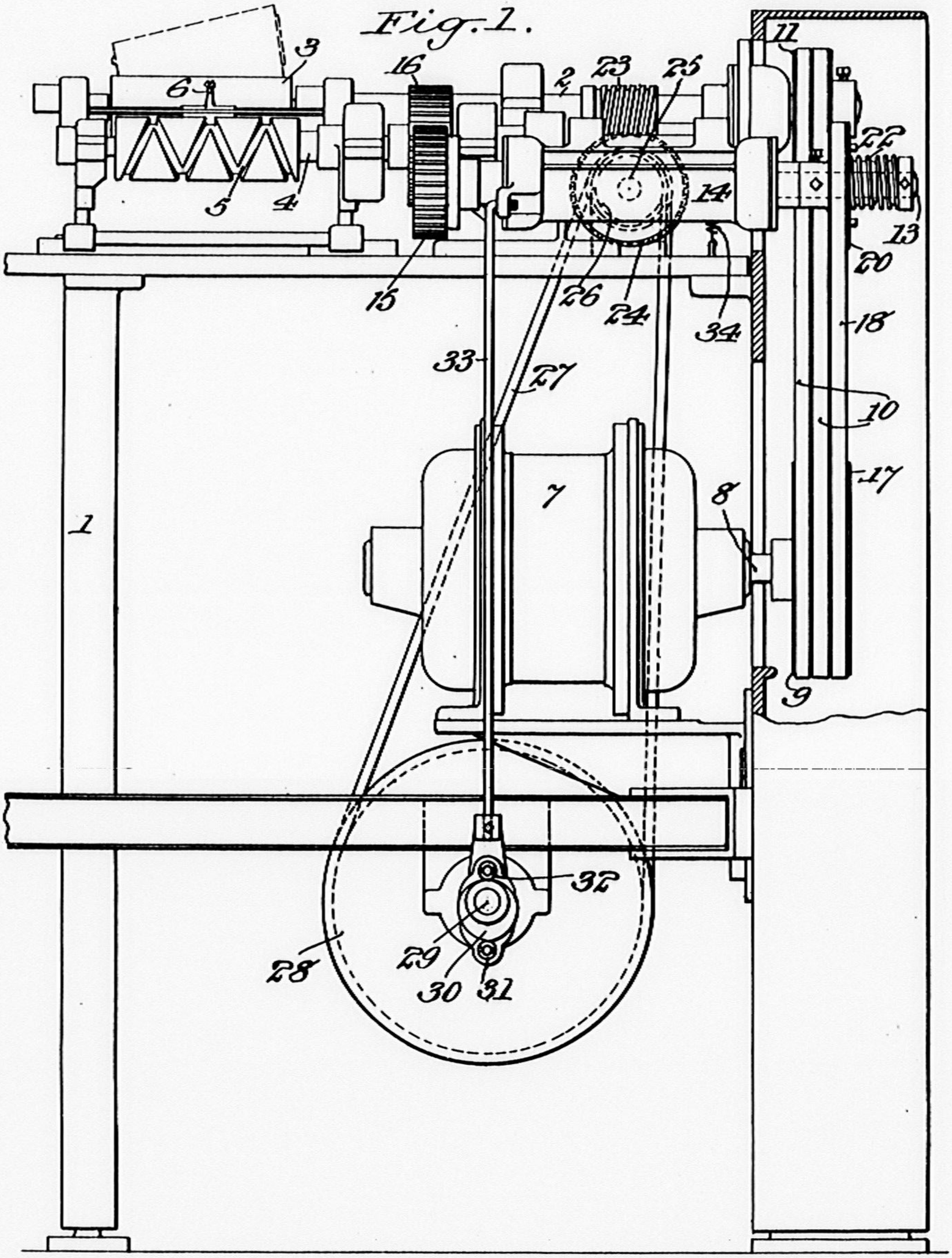
EDWARD J. ABBOTT.
WILLIAM G. ABBOTT, Jr.

March 13, 1934. J. O. McKEAN 1,950,990

PACKAGE WINDING MACHINE

Filed Dec. 23, 1931 2 Sheets-Sheet 1

Fig. 1.



INVENTOR

John O. McKean

BY

ATTORNEYS

March 13, 1934. J. O. McKEAN **1,950,990**

PACKAGE WINDING MACHINE

Filed Dec. 23, 1931 2 Sheets-Sheet 2

Fig. 2.

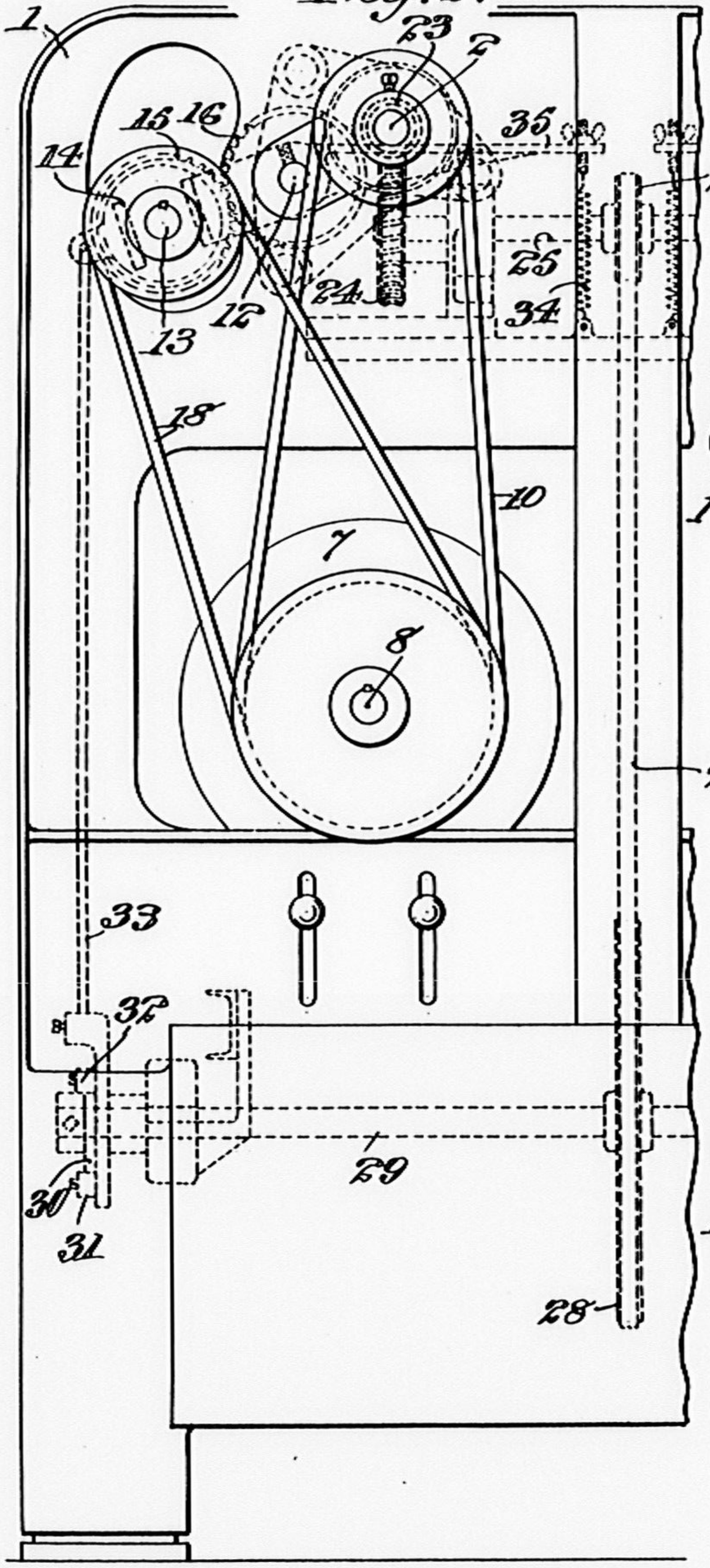


Fig. 3.

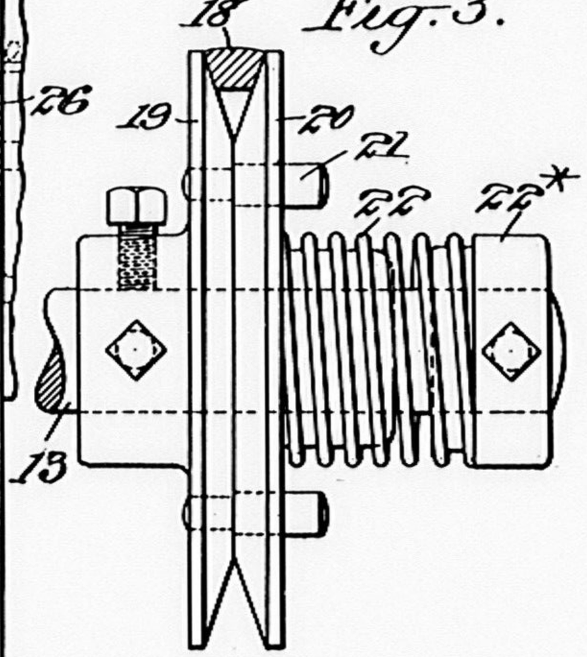
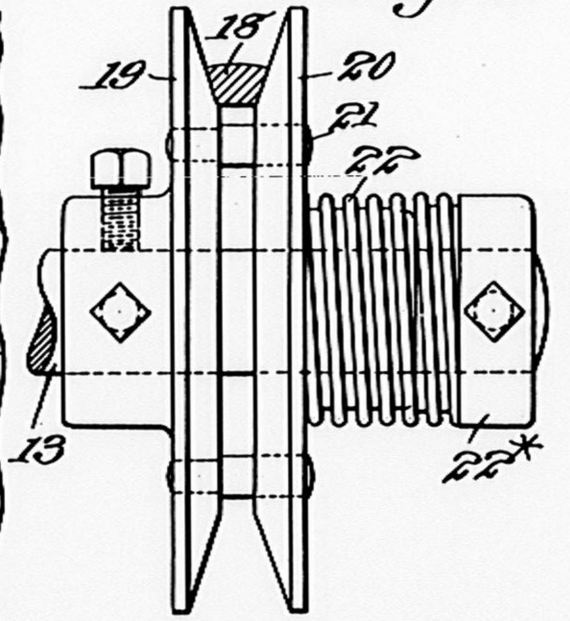


Fig. 4.



INVENTOR
John O. McKean
BY

ATTORNEYS

Patented Mar. 13, 1934 **1,950,990**

UNITED STATES PATENT OFFICE

1,950,990

PACKAGE WINDING MACHINE

John O. McKean, Westfield, Mass., assignor to
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corporation of Massachusetts

Application December 23, 1931, Serial No. 582,773

4 Claims. (Cl. 242—18)

This invention is directed to package winding machines of that type in which the packages are wound by their frictional surface contact with winding rolls.

The object of my invention is to provide a novel and simple winding mechanism which will effectually break up the ribbon wind on the package, i. e., the tendency of the yarn to lay one turn upon a preceding turn, thereby causing undesirable lumps or protuberances to be produced in the wound package.

My invention comprises generally a package winding mechanism in which the winding roll shaft is driven at a constant speed and the traverse guide actuating cam shaft is driven at a variable speed.

My invention comprises particularly a belt driven expansible pulley located in the drive for the traverse cam shaft and means exerting added tension on the belt at intervals to expand the pulley and thereby increase its speed by decreasing its effective diameter.

My invention comprises more particularly means for moving the expansible pulley bodily away from its driving pulley at intervals to increase the tension on the belt for extending the expansible pulley and thus add to its speed.

My invention also comprises a common motor having a separate drive for the winding roll and cam shafts, a variable speed control being provided for the cam shaft drive, said control being operated from the winding roll shaft.

A practical embodiment of my invention is represented in the accompanying drawings in which:

Fig. 1 represents a detail side view partly in section of a package winding machine with my improved winding mechanism applied thereto;

Fig. 2 represents a detail end view of the same;

Fig. 3 represents a detail side view of the expansible pulley which controls the speed of the traverse cam shaft, the pulley being shown in its contracted position; and

Fig. 4 represents a similar view with the expansible pulley shown in its extended position.

The winding machine frame is denoted by 1 and in suitable bearings on this frame are rotatably mounted the shaft 2 of the winding roll 3 and the shaft 4 of the variable speed traverse cam 5. The traverse guide 6 is operated by the cam 5.

The winding roll shaft 2 may be driven at a constant speed by any suitable means, such for instance as the electric motor 7, the shaft 8 of which is shown as provided with a double pulley 9 which drives through belts 10, the double pulley 11 on the winding roll shaft.

The means which I have shown for imparting a variable speed to the traverse cam shaft 4 and thereby to the traverse guide 6 is as follows:

A rock shaft 12 is mounted in suitable bearings on the frame 1 in alinement with the cam shaft 4. A shaft 13 is rotatably mounted in suitable bearings on a swinging support 14 carried by the rock shaft 12, which shaft 13 drives the cam shaft 4 through the intermeshing gears 15, 16. The shaft 13 is driven at a variable speed from the shaft 8 of the motor 7 through a belt and pulley connection, one of which pulleys is of the normally contracted expansible type. In the present instance the motor shaft 8 is provided with a drive pulley 17 of the V-groove type, which pulley drives the V belt 18 which also passes around a normally contracted expansible pulley of the V-groove type on the shaft 13. This expansible pulley comprises a fixed member 19 fast on the shaft 13 and a spring pressed member 20 slidable on the shaft 13 and interlocked to rotate with the fixed pulley member 19 by the pins 21 carried by said fixed pulley member. The spring which normally contracts the expansible pulley is denoted by 22, which spring is interposed between the movable pulley member 20 and a collar 22^a fast on the shaft 13.

The constant speed winding roll shaft 2 is provided with a worm 23 which meshes with a worm gear 24 carried by a shaft 25 mounted in suitable bearings on the frame 1. This shaft 25 is provided with a pulley 26 which drives through a belt 27, a pulley 28 on a shaft 29 mounted in suitable bearings on the said frame. This shaft 29 is provided with an eccentric cam 30 which engages the rollers 31, 32 at the lower end of a rod 33, the upper end of which rod is attached to the swinging support 14.

The weight of the swinging support 14 with the parts carried thereby is substantially counterbalanced by a spring 34 extending between the frame 1 and an arm 35 projecting rearwardly from the rock shaft 12.

In operation: As the winding roll shaft 2 is rotated from the motor 7 it will, in turn, rotate the eccentric shaft 29, causing the rod 33 to slowly rock the swinging support 14 which carries the normally contracted expansible pulley 19, 20, carried by the shaft 13 which is geared to the cam shaft 4 and which expanding pulley in turn is driven from the motor 7 through the pulley 17 and belt 18.

As the swinging support 14 is moved upwardly, increased tension is imparted to the belt 18, which increased tension will cause the pulley 19, 20 to expand, thereby bringing the belt 18 as it passes around the expanded pulley to a point closer to the axis of the shaft 13 and thereby speed up the shaft 13 and hence the cam shaft 4. This variable speed of the cam shaft 4 will in turn vary the speed of the traverse guide 6. The variable motion of the traverse guide 6 will effectually break up the tendency of the yarn to wind one strand upon the other, creating what is known as a ribbon wind.

It will be understood that when the expansible pulley is at the limit of its extended position the end of the hub of the member 20 comes in contact with the collar 22ᵃ fast on the shaft 13. This prevents the pulley from being extended so far as to allow the V belt 18 to fall or drop or be pulled between the fixed and slidable members of the pulley to a point below the bevel where the belt would become inoperative and possibly be destroyed.

It will thus be seen that a common motor separately drives the winding roll and cam shafts. It will also be seen that by providing an extensible pulley in the cam shaft drive and employing means for extending the pulley at intervals I am enabled to produce a simple and effective means for accomplishing the result sought.

It is evident that various changes may be resorted to in the construction, form and arrangement of the several parts without departing from the spirit and scope of my invention, and hence I do not intend to be limited to the particular embodiment herein shown and described, but

What I claim is:

1. In a package winding machine, a winding roll shaft, a traverse cam shaft, means for driving said traverse cam shaft at a varying speed including a belt and its pulleys, one of the pulleys being expansible, a geared connection between the expansible pulley and one of said shafts, a movable support for the expansible pulley and means operated from the winding roll shaft for moving said support and its expansible pulley away from the other pulley at intervals to increase the tension on the belt for extending the expansible pulley.

2. In a package winding machine, a traverse cam shaft, means for driving it at a varying speed comprising a belt and its pulleys, one of the pulleys being expansible, a rock shaft mounted in alinement with the cam shaft, a swinging support on the rock shaft, a shaft for the expansible pulley rotatably mounted in the swinging support, gearing connecting the last named shaft with the cam shaft and means for rocking said support to increase the tension on the belt for extending the expansible pulley.

3. In a package winding machine, a winding roll shaft, a traverse cam shaft, means for driving said traverse cam shaft at a varying speed comprising a belt and its pulleys, one of the pulleys being expansible, a rock shaft mounted in alinement with the cam shaft, a swinging support on the rock shaft, a shaft for the expansible pulley rotatably mounted in the swinging support, gearing connecting the last named shaft with the cam shaft and means operated from the winding roll shaft for rocking said support to increase the tension on the belt for extending the expansible pulley.

4. In a package winding machine, a winding roll shaft, a traverse cam shaft, a common motor having a separate belt and pulley drive for each shaft, the cam shaft drive including an expansible pulley and means operated from the winding roll shaft for increasing the tension on the cam shaft belt at intervals to extend the pulley.

JOHN O. McKEAN.

Fig. 2.

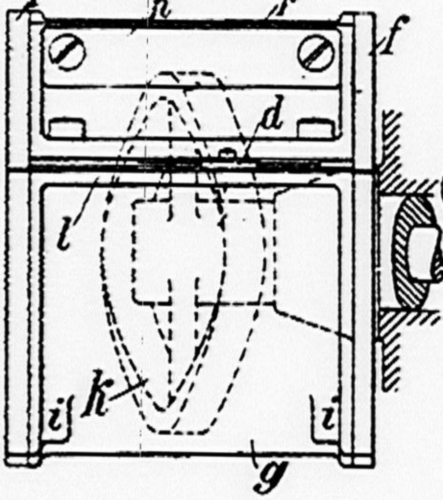


Fig. 1.

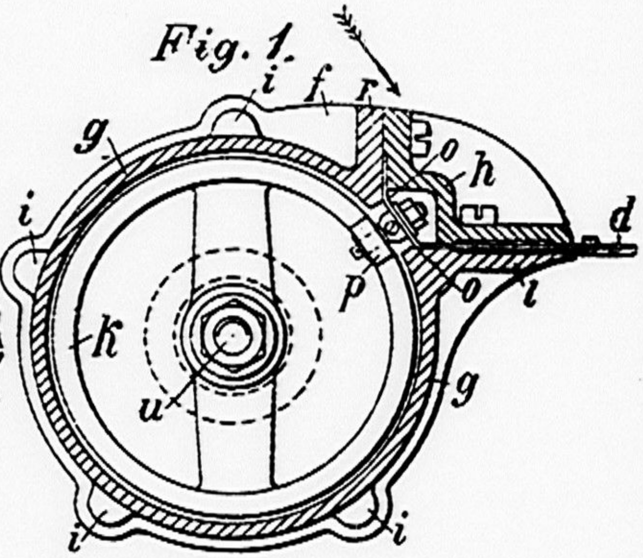


Fig. 3.

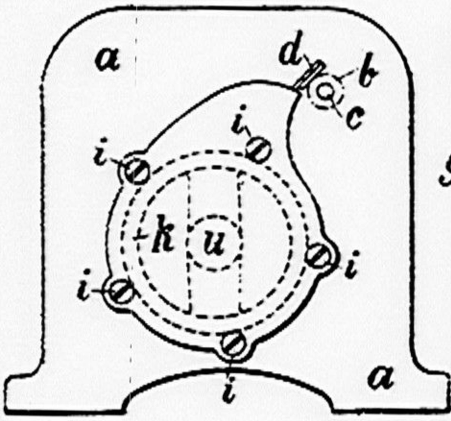


Fig. 4.

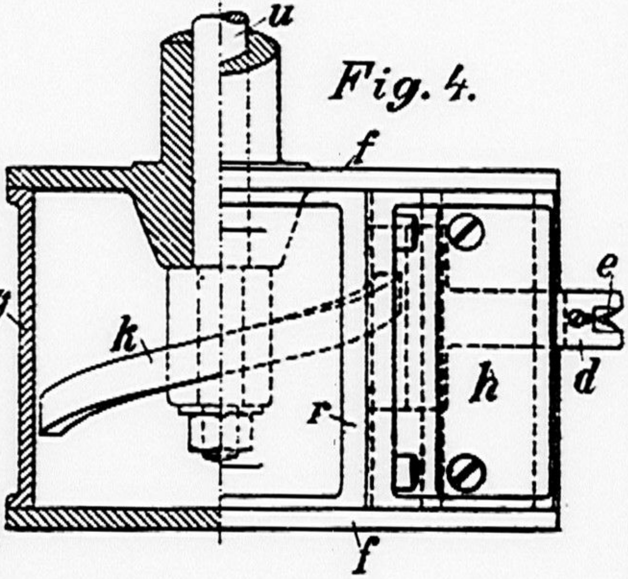
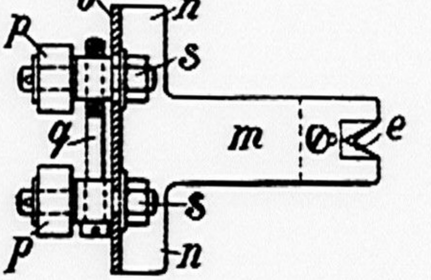


Fig. 5.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho.

N° 2102 A.D. 1901

Date of Application, 30th Jan., 1901—Accepted, 23rd Mar., 1901

COMPLETE SPECIFICATION.

Improvements in Thread Guiding Mechanism for Cross Winding Frames.

I, RUDOLPH VOIGT, Machine Manufacturer, of 36 Limbacherstrasse, Chemnitz, in the Kingdom of Saxony, Germany, do hereby declare the nature of my invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The object of the present invention is a thread guiding mechanism for a cross winding frame and is based upon the idea of reducing to as great an extent as possible the thread guide which moves quickly to and fro, in order to increase as much as possible its number of oscillations, and consequently the capacity of the machine. However, this object could not be attained for any length of time, but would on the other hand result in a quick wear and tear of the thread guide which is very great, if a second arrangement were not provided by means of which said quick wear and tear is avoided. The said second arrangement consists in the fact that all movable parts are tightly enclosed in consequence of which, they can be freely lubricated and protected against soiling, and by means of which the further advantage is obtained that the attendant cannot be injured by said working parts.

In the annexed drawing:—

Fig. 1 shows a side view, partly in section.

Fig. 2 is a plan view thereof.

Fig. 3 is a general view of the arrangement showing the positions of the parts shown in Fig. 2 during the operation of the machine.

Fig. 4 represents on the right a plan view and on the left a horizontal section through the mechanism.

Fig. 5 shows the thread guide alone in plan, seen in the direction of the arrow in Fig. 1.

In Fig. 3 *a* shows the frame plate of a cross winding frame. The working parts of the machine are a spindle *c* revolving at very great speed and the thread guide *d*. The latter is shown in all the figures of the drawing, and is provided at its outer end with a V-shaped notch *e* in which the thread to be wound is placed. Whilst the thread guide moves to and fro in front of the spindle *c* the thread is wound upon the bobbin *b* in the form of a spiral line. The thread guide *d* is shown in horizontal position in Figs. 1, 2 and 4 in order to render the figures as clear as possible. When the machine is in operation however, the thread guide *d* and the casing *f g h* which is revolvable round the shaft *u* occupy the oblique position shown in Fig. 3.

The casing consists of a cylindrical drum *g* closed at both ends by means of two covers *f* which are fixed for instance, by means of the screws *i*.

In the interior of the drum the cam disc *k* revolves operated by the shaft *u*. The outer wall *g* of the drum is formed as a slideway at *l* and *r* in which the thread guide *d* slides and is passed through the angle-piece *h* screwed thereon. The said thread guide is operated by the cam disc *k* by means of rollers *p* running thereon (Figs. 2 and 5).

The thread guide is shown separately in Fig. 5. As mentioned above it has to be as light as possible For this purpose according to the present invention, it is made preferably of a T-shaped piece of sheet metal. The central part *m*

[*Price* 8*d.*]

[This Drawing is a reproduction of the Original on a reduced scale.]

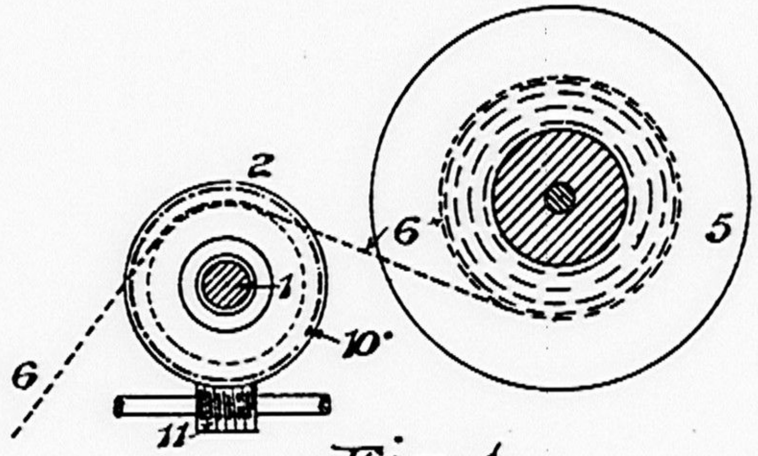


Fig. 1.

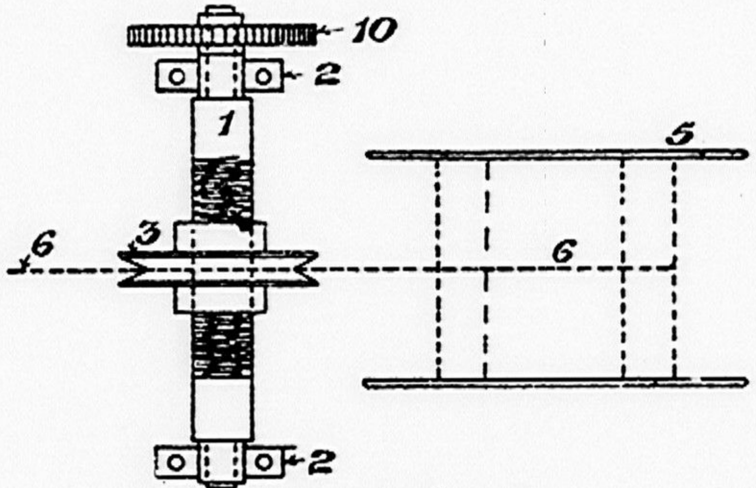


Fig. 2.

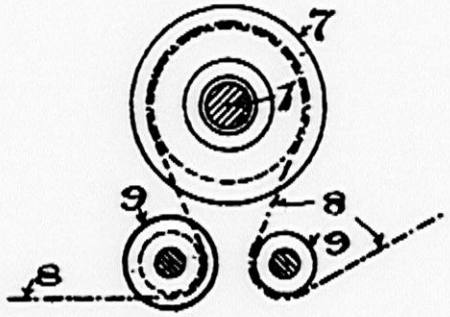


Fig. 3.

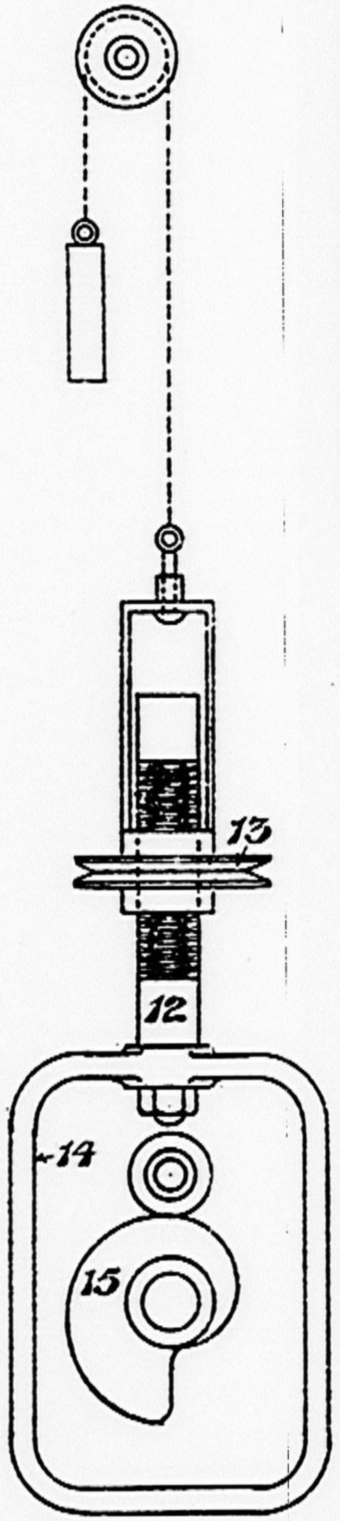


Fig. 4.

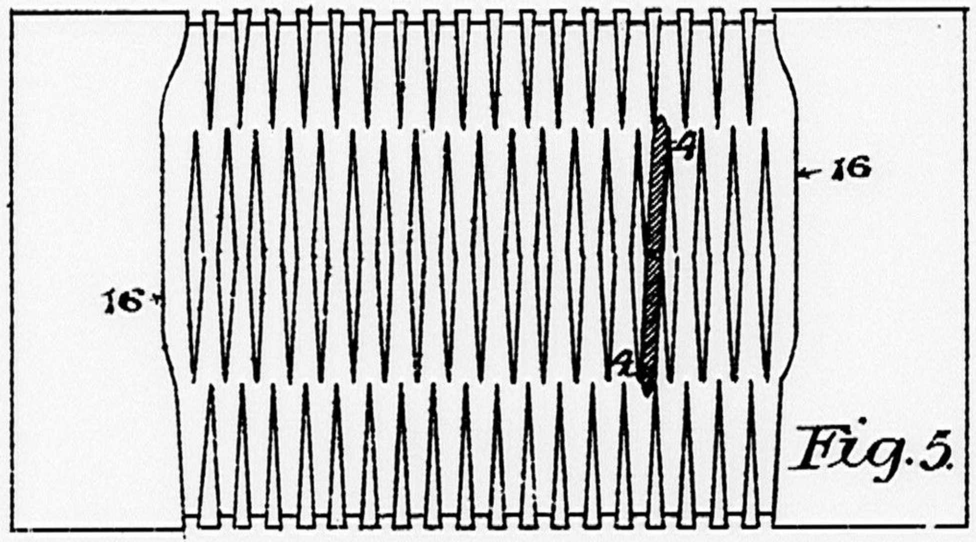


Fig. 5.

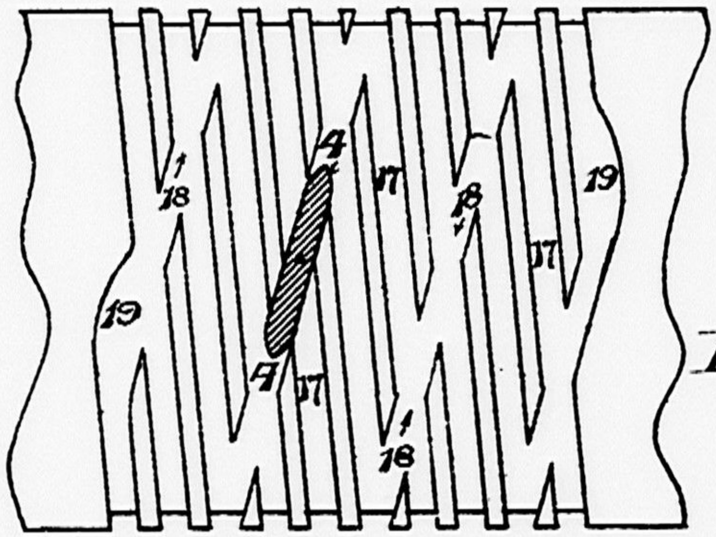


Fig. 6.

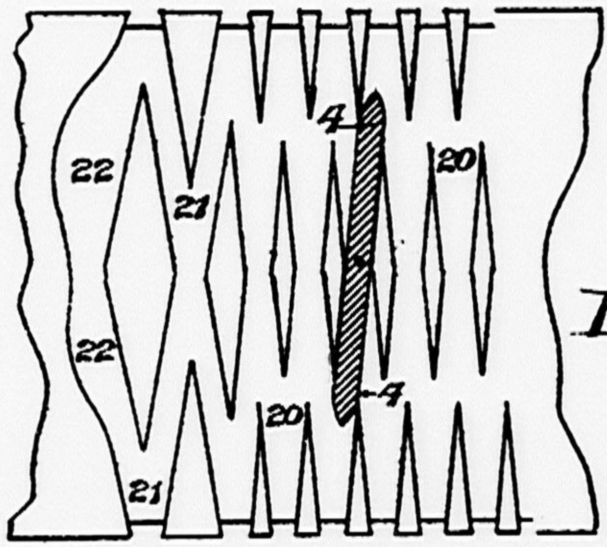


Fig. 7.

Malby & Sons, Photo-Litho

same or different pitches and either or both screw threads may have a varying pitch, also, the spindle may have an independent positive rotary or axial movement which may be continuous or intermittent for the purpose of changing the position of the traverse.

Dated this 4th day of November, 1916.

W. H. POTTER, Wh.Sc.,
Patent Agent,
Albert Street, Nottingham,
Agent for the Applicant.

COMPLETE SPECIFICATION.

Improvements in and relating to Screw and Nut Mechanism.

I, THOMAS HENRY JONES, of The Standard Machine Works, Lenton, Nottingham, Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in a type of traversing mechanism in which there is a stationary spindle having right and left hand screw threads upon the same part of the spindle and a pulley provided with a pawl which engages with the screw thread, and in which the pulley has been rotated by a wire or the like, the said wire having being passed two or more times round the pulley for the purpose of rotating the same as the wire was drawn forward by the winding drum.

The present invention has for its object the production of a screw and nut traversing mechanism of the type herein referred to and suitable for traversing yarns, cords, tapes and similar textile fabrics.

According to this invention, as arranged for the traversing of yarns, cords, and similar flexible materials, the spindle is fixed in a suitable position and the ends of the screw threads upon the spindle meet at both ends of the traverse. The traversing pulley has a vee groove and is bored to rotate upon the spindle and the inside of the hole is fitted with a pivoted switch which engages the screw thread upon the spindle and is of such a length that when engaged with either thread it passes the crossings of the two threads. At the ends of the screw threads the switch is automatically directed from the right hand thread to the left hand thread at one end, and from the left hand thread to the right hand thread at the other end. The yarn, cord, or the like is passed over part of the surface of the pulley and as it moves forward or backward, it causes the pulley to rotate and it is thereby traversed to and fro, or the yarn, cord, or the like may pass partly round a vee grooved pulley.

When the improved mechanism is used for traversing tapes, ribbons, or the like the pulley upon the screwed spindle is made with flanges and there are guide rollers by which the material is held in contact with a suitable portion of the circumference of the pulley, also there may be pressure rollers which traverse with the pulley and hold the material in contact with the pulley.

The right and left hand screw threads upon the same spindle may have the same or different pitches and either or both may have a varying pitch, also the spindle may have an independent rotary or axial movement for the purpose of changing the position of the traverse.

In the accompanying drawing:—

Fig. 1 is a sectional elevation of one form of the improved mechanism.

Fig. 2 is a plan of the same.

Fig. 3 is a sectional elevation of a traversing pulley and guide pulleys for tapes and the like.

Fig. 4 is an elevation of a vertical traversing screw and mechanism for raising and lowering the same.

Fig. 5 is a development of a spindle provided with right and left hand screw threads of the same and constant pitch.

Fig. 6 is a development of a spindle provided with right and left hand screw threads of different pitches, and

Fig. 7 is a development of part of a spindle provided with right and left hand screw threads of varying pitch.

According to one method of carrying out this invention the spindle 1 is fixed in its bearings 2 and is provided with a right hand screw thread and a left hand screw thread on the same part of the spindle. Freely rotatable upon the spindle there is a vee grooved pulley 3 which is provided with a switch piece 4, Figs. 5, 6 and 7, the said switch being shaped to fit the screw thread and being of such a length that it spans the crossings of the two threads on the spindle. This switch is pivotally attached to the inside of the pulley and may be mounted upon an axle carried by the pulley, or be attached to an axle which has a bearing in the boss of the pulley or in one of a pair of half sleeves or bushes to the outside of which the pulley is attached. The improved traverser is used in connection with a take-up roller or drum 5, or a spindle, which is positively driven at a suitable speed, and the angle of the groove in the pulley is made sufficiently acute to grip the thread, cord, or the like 6 to be traversed.

In the modification shown in Fig. 3 and designed for traversing tapes, ribbons and the like, the traversing pulley 7 on the screw 1 is made with side flanges and of a width suitable for the material 8, and to ensure a surface grip between the material and the pulley the material is guided to and from the pulley by guide pullies 9. These pullies may have side flanges and traverse on their axles with the material or they may be long enough for the material to traverse upon. In addition to the parts described the pulley 7 may be fitted with a pressure roller for pressing the material on to the face of the pulley 7 and such pressure roller is fitted to traverse with the pulley 7.

In the arrangements herein described the spindle is held stationary and the traverse is obtained by the material to be traversed rotating a nut or its equivalent upon the stationary spindle. In other cases the spindle is intermittently or continuously rotated for the purpose of varying the number of windings in a given distance on the receiving drum or spindle. In one arrangement the screw is fitted with a toothed worm wheel 10, Figs. 1 and 2, and is driven by a worm 11, which arrangement can also be used for holding the spindle stationary. If the spindle is rotated in the same direction as the pulley the number of windings upon the receiving drum for each traverse is increased, and the number is decreased if the spindle is rotated in the opposite direction to that of the pulley. The worm 11 may be driven by ratchet mechanism or by change speed gear, or the driving gear may be applied to the spindle direct.

In the arrangement shown in Fig. 4 the spindle 12 and the pulley 13 are constructed and arranged in the same manner as the corresponding parts shown in Figs. 1 and 2, and the spindle may be horizontal or vertical, but when vertical the weight of the pulley is, or may be, balanced by a weight or spring. In this arrangement the spindle is carried by a frame 14 which is fitted to slide in suitable guides and is moved in such guides by a cam 15 or equivalent means for the purpose of varying the position of the traversed windings upon the receiving drum or spindle.

The right and left hand screw threads upon the spindle may be of the same pitch and such pitch may be regular and equal for the whole length of the threaded portion of the spindle as shown in Fig. 5. The switch 4 is sufficiently long to ensure it passing the crossings of the threads and remain in one of them and at both ends of the threaded portion of the spindle there is a cam shaped

Sept. 1, 1925. **1,551,764**

F. MÜLLER

POWER TRANSMISSION CHAIN

Filed April 8, 1922

Fig. 1.

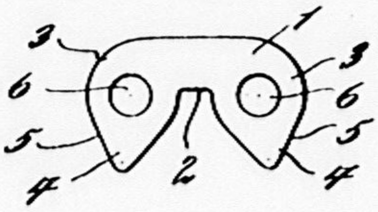


Fig. 2.

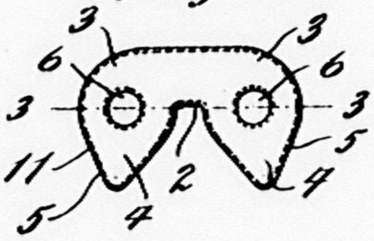


Fig. 3.

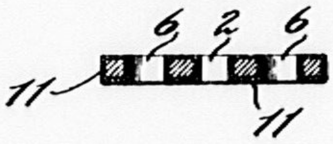


Fig. 4.

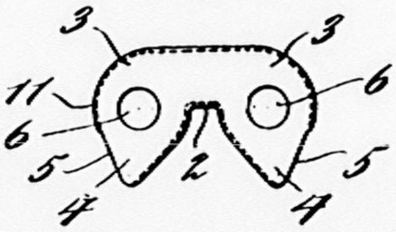


Fig. 5.

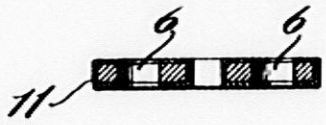


Fig. 6.

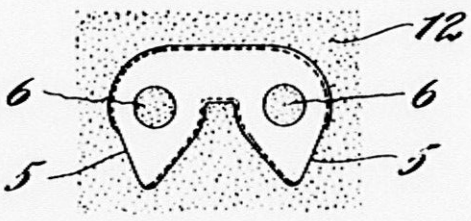
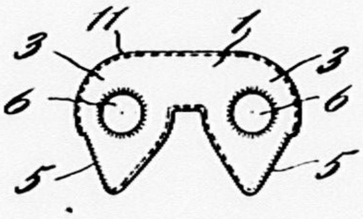


Fig. 7.



Inventor
Friederich Müller
By Gifford & Bull
his Attorneys

Patented Sept. 1, 1925. 1,551,764

UNITED STATES PATENT OFFICE.

FRIEDERICH MÜLLER, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE WHITNEY MFG. CO., OF HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT.

POWER-TRANSMISSION CHAIN.

Application filed April 8, 1922. Serial No. 550,824.

To all whom it may concern:

Be it known that I, Friederich Müller, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Power-Transmission Chains, of which the following is a specification.

My invention relates to new and useful improvements in power-transmission chains, and particularly contemplates a new and improved chain link and the process of producing the same.

Power transmission chains have been made consisting of flat links or plates provided with teeth adapted to engage the teeth of driving or driven gears, which plates or links are provided with end openings adapted to receive various forms of transverse members or joint-making members, in order to connect the links lengthwise of the chain, and also for building up a chain of the desired width.

The present invention is applicable generally to all forms of toothed-plate links provided with such openings, the object being to provide a link in which the openings receiving the transverse members or the engaging faces which contact the gear teeth, or both of the same, may be so made as to eliminate or reduce wear of said faces.

The invention consists in the improved article and method to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings I have shown a preferred form of the article and the preferred form of producing the same.

In the drawings, Figure 1 is a plan view of a plain chain link on which my invention is carried out; Fig. 2 is a view similar to Fig. 1 showing the link provided with a protecting coating; Fig. 3 is a section taken along the plane of the line 3—3 of Fig. 2; Fig. 4 is a view similar to Fig. 2 showing the coating removed from the contact bearing portions of the link; Fig. 5 is a longitudinal section through Fig. 4; Fig. 6 illustrates the link of Fig. 4 embedded in carbon and to be subjected to a carburizing process, and Fig. 7 is a plan view of a link made in accordance with my invention.

Referring to the drawings by characters of reference, 1 designates, generally, a link plate made from a flat piece of suitable metal and having an intermediate portion 2 and end portions or heads 3, the end portions or heads being provided with teeth 4 having faces 5 adapted to cooperate with a transmission gear (not shown). The heads of the links are each provided with an opening 6, in the present instance circular in form, and adapted to receive a transverse member by which the overlapping ends of similar links may be connected in order to build up the chain longitudinally and to assemble the links transversely to give a chain of the desired width and length.

The link is preferably made from wrought iron or low-carbon steel—that is, from that type which does not contain sufficient carbon to permit of sufficient hardening for the purpose intended—and in order to prevent wear of the contact faces, said link is subjected to a process whereby the bearing surfaces only of the link are case-hardened.

In order to produce the new link shown in Fig. 7, I first completely coat or plate the link shown in Fig. 1 with a suitable coating 11, for instance, copper or nickel plating, in a known manner, and of a material which is substantially impervious to, or will not be attacked by, the usual carburizing processes. This coating is employed, as hereinafter described, in order to prevent access of carbon during the carburizing process to those portions of the link which it is not desired to harden. The coating is then removed from the link at those portions which it is desired to expose to the carburizing operation, and in the process illustrated, the coating around the edges of the openings 6 is removed by enlarging the openings to the dotted line position shown in Fig. 2 and to the size shown in Fig. 4 by a reaming operation, in a well-known manner, and the coating around the bearing portion of the outer edge, in the present case along the surfaces 5, is removed, as illustrated in Fig. 4, by a milling cutter, or other suitable means. It will, of course, be understood that the copper, or other coating, is very thin and the thickness of the coating is much exaggerated in the drawings.

The link so formed with the bearing surfaces only exposed is then subjected to a carburizing process by embedding the same in contact with bone, charcoal, gas, or other suitable carburizing material 12, so that the latter comes in contact with the exposed bearing surfaces of the link, and the mass is then subjected to suitable temperatures, well known in the art. When the carburizing process has been completed, the links are removed from the carburizing material and preferably quenched in water, oil or other suitable cooling medium, to produce case-hardening of the parts of the link which have been exposed to the carburizing process.

In accordance with my invention, only the bearing portions, in the case illustrated the portions around the openings and on the edges 5 of the link, are hardened thereby and leaving the main body of the link with the same properties as originally possessed by the material from which the links are made. It will be understood, of course, that the hardening process if applied to the entire link, or to a substantial portion thereof, would make the same brittle, thereby causing the same to break in use. By restricting the hardening to the bearing surfaces of the link, the body of the link is not deprived of the properties possessed by the material from which the link is made, and while the bearing surfaces are well adapted to resist the wear to which the link is subjected, there is no more tendency for the link to break in use than is the case with an ordinary chain link.

What I claim and desire to secure by Letters Patent of the United States is:—

1. The method of making a chain link which consists in completely stamping out the blank including the pivot holes, covering all parts of the same with a coating protecting it against carburization, removing the coating at all portions desired to be hardened during the finishing operation, and then subjecting the link to carburization.

2. The method of making a chain link which consists in completely stamping out a blank including the pivot holes, covering all parts of the same with a coating protecting the same against carburization, removing the coating at the pivot holes and at the bearing surfaces which engage with the sprockets during the finishing operation, and then subjecting the link to carburization.

3. As a new article of manufacture, a chain link hardened only at the bearing surfaces on the pivots and the bearing surfaces engaging with the sprockets.

FRIEDERICH MÜLLER.

Dec. 22, 1925. **1,566,704**

G. M. STEVENS

RUBBER FRICTION DRIVE RING

Filed Sept. 17, 1924

Fig. 1.

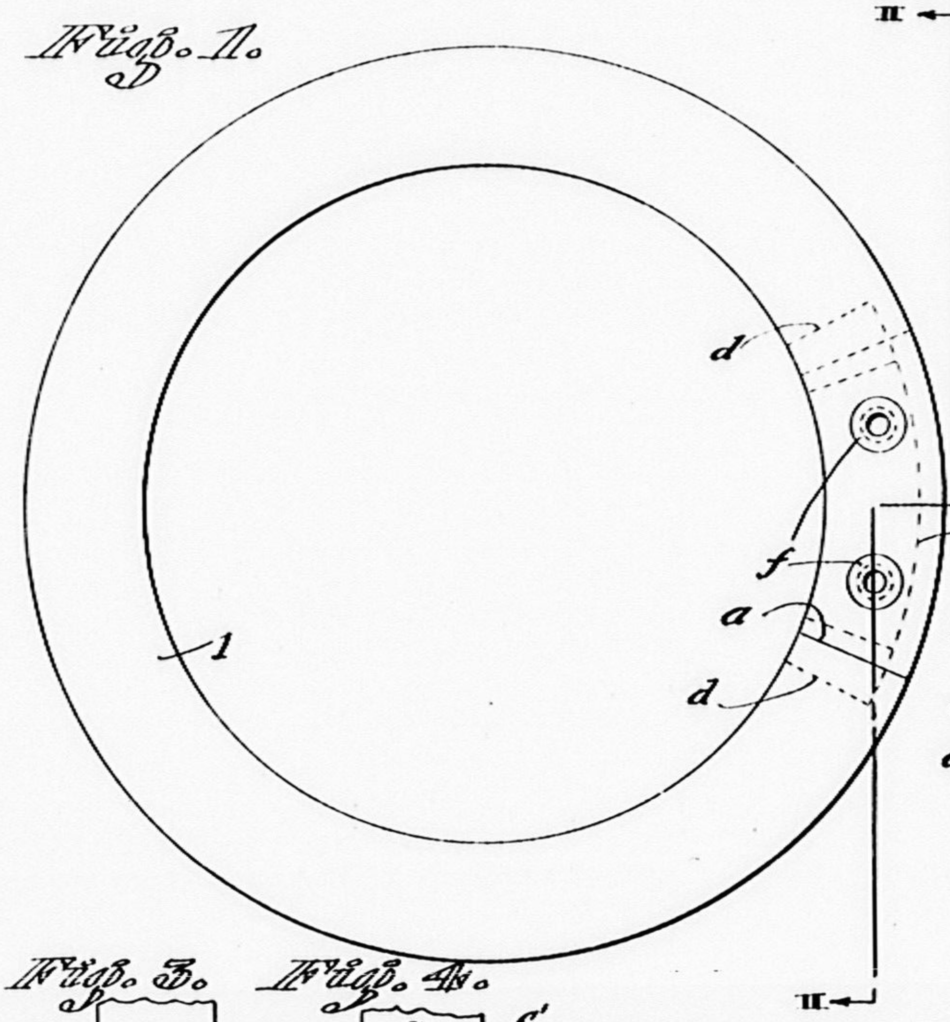


Fig. 2.

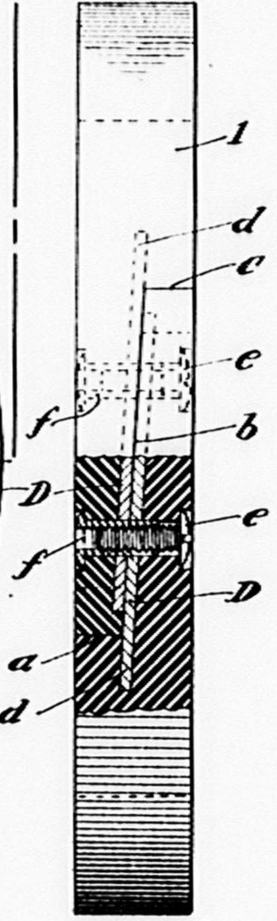


Fig. 3.

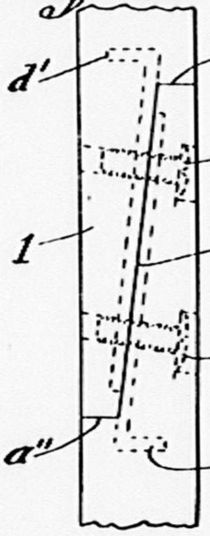


Fig. 4.

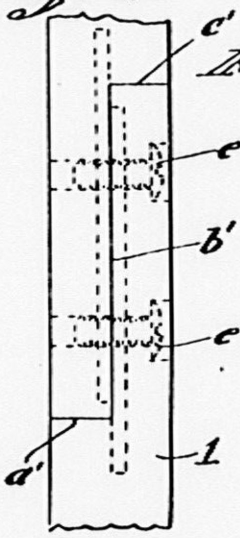


Fig. 5.

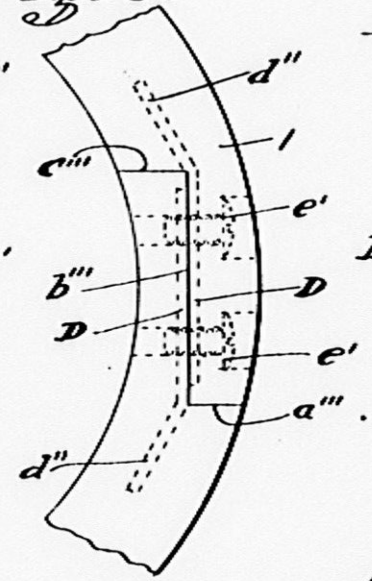
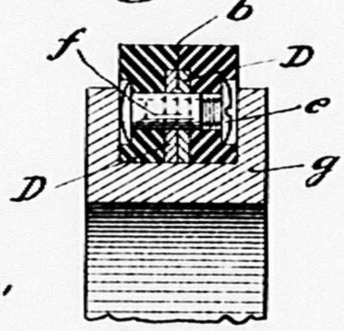


Fig. 6.



Inventor
GEORGE M. STEVENS

By Munn & Co.

Attorneys

Patented Dec. 22, 1925. **1,566,704**

UNITED STATES PATENT OFFICE.

GEORGE M. STEVENS, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-THIRD TO JOHN C. BALLETTI AND ONE-THIRD TO WILLIAM C. ANDERSON, BOTH OF SAN FRANCISCO, CALIFORNIA.

RUBBER FRICTION DRIVE RING.

Application filed September 17, 1924. Serial No. 738,317.

To all whom it may concern:

Be it known that I, GEORGE M. STEVENS, a citizen of the United States, and a resident of San Francisco, county of San Francisco, State of California, have invented a new and useful Rubber Friction Drive Ring, of which the following is a specification.

This invention relates to friction driving wheels or disks in general and in particular to a rubber drive ring as used on certain can making machinery and known to the trade as a "slitter ring",

This ring is used as a friction drive disk and ordinarily consists of a solid soft rubber ring positioned in the groove of a flange on the machine and making it necessary in replacing the rings to strip the shaft or remove it from its bearings, and the object of my invention is to provide a rubber slitter ring having a special split joint whereby the rubber ring may be renewed easily and quickly without stripping the shaft.

In the drawings accompanying this application, I show several modifications of the split joint applied to a slitter ring all embracing the same principles which make my ring a demonstrated success in regular use on a number of machines.

Figures 1 and 2 show respectively in plan and edge views my preferred construction using a pair of threaded sleeves and screws for fastening the joint, Figures 3 and 4 show modifications in the angularity of the joint using common screws, Figure 5 shows the joint applied on the side of the ring instead of the edge and Figure 6 is a cross section of the ring at the joint constructed as in Figure 1 and seated in place in the grooved flange of the machine.

In the figures 1 is a soft resilient rubber ring with a stepped split joint so that the ring may be opened up.

The joint in Figures 1 and 2 is formed along the lines *a*—*b*—*c*, the line *b* being substantially parallel to the side of the ring.

In Figure 4 the joint *a'*—*b'*—*c'* is shown with the line *b'* exactly parallel, and in Figure 3 the joint *a''*—*b''*—*c''*, the line *b''* is at a decided angle to the sides of the ring, whereas in Figure 5 the joint *a'''*—*b'''*—*c'''* is shown applied to the side of the ring.

On opposite ends of the rubber ring forming the joint are metal plates vulcanized into the rubber. These plates in all figures are designated D and are placed in the rubber at the joint surface so that when the joint is closed, the plates will lie against one another and are so secured by suitable screws.

The plates extend into the solid part of the ring beyond the joint, as shown at *d*, and in Figure 3 the extending ends are bent at an angle, as shown at *d'* to hook into the rubber, while in Figure 5 the extending ends *d''* are bent but slightly to follow the direction of the ring, and in all views the plates are shown as terminating just short of the ends of the ring to which they are respectively vulcanized.

To secure the joint, I preferably used threaded screws *e* passing into threaded sleeve *f* as shown in Figure 2 wherein the joint is partly shown in section along the line 2—2 of Figure 1.

Countersunk holes are formed in both ends of the ring joint extending through both metal plates of a size to pass the threaded sleeves as shown, so that when the joint is tightened by the screws, the strain is taken entirely by the metal plates against the sleeves, and when the ring is joined and sprung into the grooved flange *g* of the machine, as shown in Figure 6, the screws are confined by the flange walls against working loose.

It should also be noted in this view that the plates are set below the outer diameter of the rubber ring to provide a large amount of rubber, as indicated at *h*, to take the wear of the drive.

In place of the threaded sleeves, plain screws may be used as shown in Figures 3, 4 and 5 at *e'*.

Having thus described my invention, it should be noted that it is not merely a split collar of the common type, but it is a split soft rubber ring with a special reinforced joint preventing the joint from opening up at this point of weakness, and also the reinforcement is placed in a position overcoming interference with frictional driving periphery of the ring, and furthermore the position of the locking screws form a co-operating combination with the flanges of the machine which overcomes any possibility of the joint coming apart.

I claim:

1. A soft rubber drive ring of the character described provided with a split joint, said joint comprising overlapping ends with a reinforcing plate vulcanized to each end arranged for bolting together, and the plate on each end extending beyond the overlapping of the joint into the solid body of the ring.

2. A soft rubber drive ring of the character described provided with a split joint, said joint comprising overlapping ends with a reinforcing plate vulcanized to each end arranged for bolting together, and the plate on each end extending beyond the overlapping of the joint into the solid body of the ring, and terminating short of the extreme end to which it is vulcanized.

3. A split ring of the character described comprised of soft rubber with an overlapping joint, a reinforcement incorporated in the joint, a threaded sleeve extending from one side of the ring through the soft rubber and through the reinforcement and a screw extending from the other side of the ring through the soft rubber and engaging the threaded sleeve.

4. In combination a grooved machine element and a soft rubber friction drive ring provided with a split joint with overlapping ends, screws clamping the overlapping ends together, said ring adapted to be seated in the grooved machine element and constructed so that the sides of the groove extend beyond the screws whereby the screws are retained against displacement.

GEORGE M. STEVENS.

James H. Rowley.

CHURN.

72087

PATENTED
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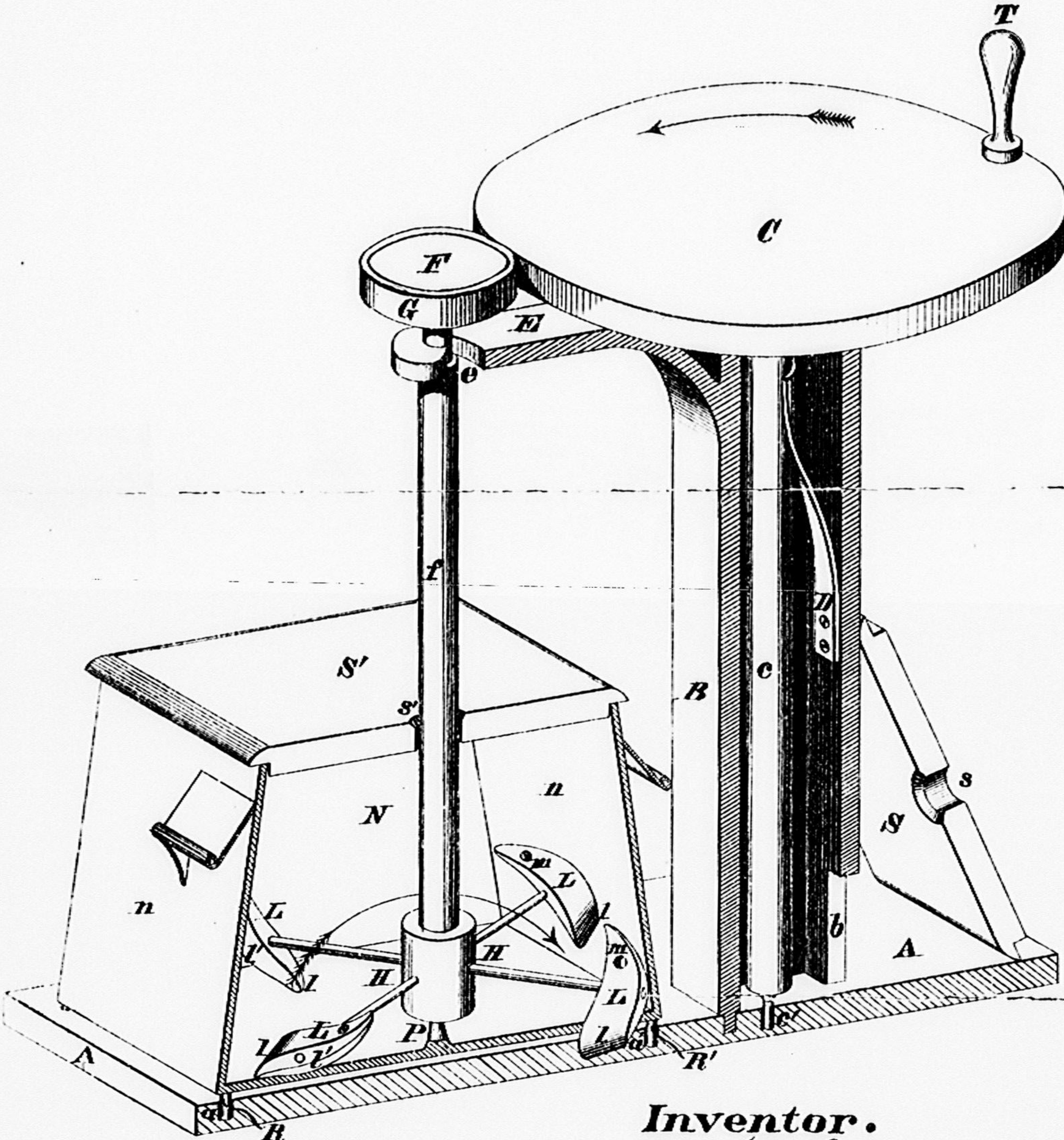


Inventor.

J. H. Rowley
By Knight Bros
Attys.

Attest.

Jas. H. Layman
Jos. A. Wheeler

United States Patent Office.

JAMES H. ROWLEY, OF VANCEBURG, KENTUCKY.

Letters Patent No. 72,087, *dated December* 10, 1867.

IMPROVEMENT IN CHURNS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, James H. Rowley, of Vanceburg, Lewis county, Kentucky, have invented a certain new and useful Improvement in Churns; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing, making part of this specification.

My invention relates to that class of churns in which the butter is produced by dashers revolving in a horizontal plane, and the main feature of my improvements consists in imparting a high velocity to said dashers by means of friction-wheels, thereby dispensing with gearing or belts; the first of which is objectionable on account of its cost and the noise produced by it when in operation, and the latter is never reliable, because it is effected by the change of temperature, being too tight at some times and too slack at others.

In the accompanying drawing a churn embodying my improvements is shown by a longitudinal section partially in perspective.

A represents the base or bed-plate of the apparatus, and rising vertically from this bed-plate is a standard, B, which encloses the shaft *c* of the driving-wheel C, and also a spring, D, which is constantly pressing against said shaft *c*, for a purpose which will be hereafter explained. The lower end of the shaft *c* is provided with a journal, *c'*, which has its bearing within the bed-plate A, and the driving-wheel, together with its shaft and journal-bearing, can be detached from the apparatus by simply lifting it out of the standard B. Projecting horizontally from the standard B is a bracket, E, notched at *e* to receive the shaft *f* of a friction-pulley, which consists of a disk, F, whose periphery has secured to it a band, G, of India rubber, leather, or other suitable material. The lower portion of the shaft *f* is provided with a number of horizontal arms, H, whose outer ends have attached to them dashers L, which are set obliquely to said arms. The faces I of these dashers, which oppose the cream as they are rotated, are flat, excepting their lower ends *l*, and these are rounded off, so as to enable the cream to ascend the inclined flat faces I with the least amount of resistance. The backs, *l'*, of the dashers are also rounded, so as to allow the particles of cream to rush together behind the dashers when they are operating, thereby increasing the agitation. The apertures *m* in the upper part of the dashers also serve to increase the agitation. The dashers revolve within a cream-chamber, N, which is square in its horizontal section, and its sides *n n* have the represented inwardly inclined form. These inclined sides compel the cream to be deflected therefrom, and to fall back in the centre of the vessel, and the angular shape of said vessel breaks up the vortex caused by the rotation of the dashers, and produces counter currents and eddies in the cream, which greatly increase the agitation. The bottom of the cream-chamber has an upwardly-projecting stud, P, which serves as a journal for the lower end of the dasher-shaft *f*. R R' are lugs, which are attached to the cream-chamber, and these lugs enter suitable sockets *a a'* in the bed-plate, and thereby confine the cream-chamber in its proper position. This provision of the lugs and sockets permits of the cream-chamber being detached from the bed-plate in a minute's time, whenever it is desired to empty or cleanse said chamber. The top of the chamber is closed by two lids S S', which have central apertures *s s'* for the admission of the dasher-shaft. T is the handle by which the driving-wheel C is rotated in the direction indicated by the red arrow. *b* is an opening in the bottom of standard B, to permit of the jonrnal-bearing *c'* being oiled, and it also enables the operator to insert the bearing in its proper position after it has been removed. The spring D retains the driving-wheel C in contact with the friction-pulley F G with a constant and uniform pressure, and, owing to the direction in which the dasher-shaft *f* is rotated, it has no tendency to escape from the notched bracket E *e*.

The provision of the spring D is a feature peculiar to my churn, and the apparatus would not be as effective as it now is if it was omitted, as it makes no difference how much the shafts may wear or get out of line, for the spring will always keep the operating parts in contact with each other.

I claim herein as new, and of my invention—

The arrangement, substantially as described, of the driving-wheel C, shafts *c c'*, spring D, notched bracket E *e*, and friction-pulley F G, for the purpose of imparting a rotary motion to the dasher-shaft *f* in the manner herein described and set forth.

In testimony of which invention, I hereunto set my hand.

JAMES H. ROWLEY.

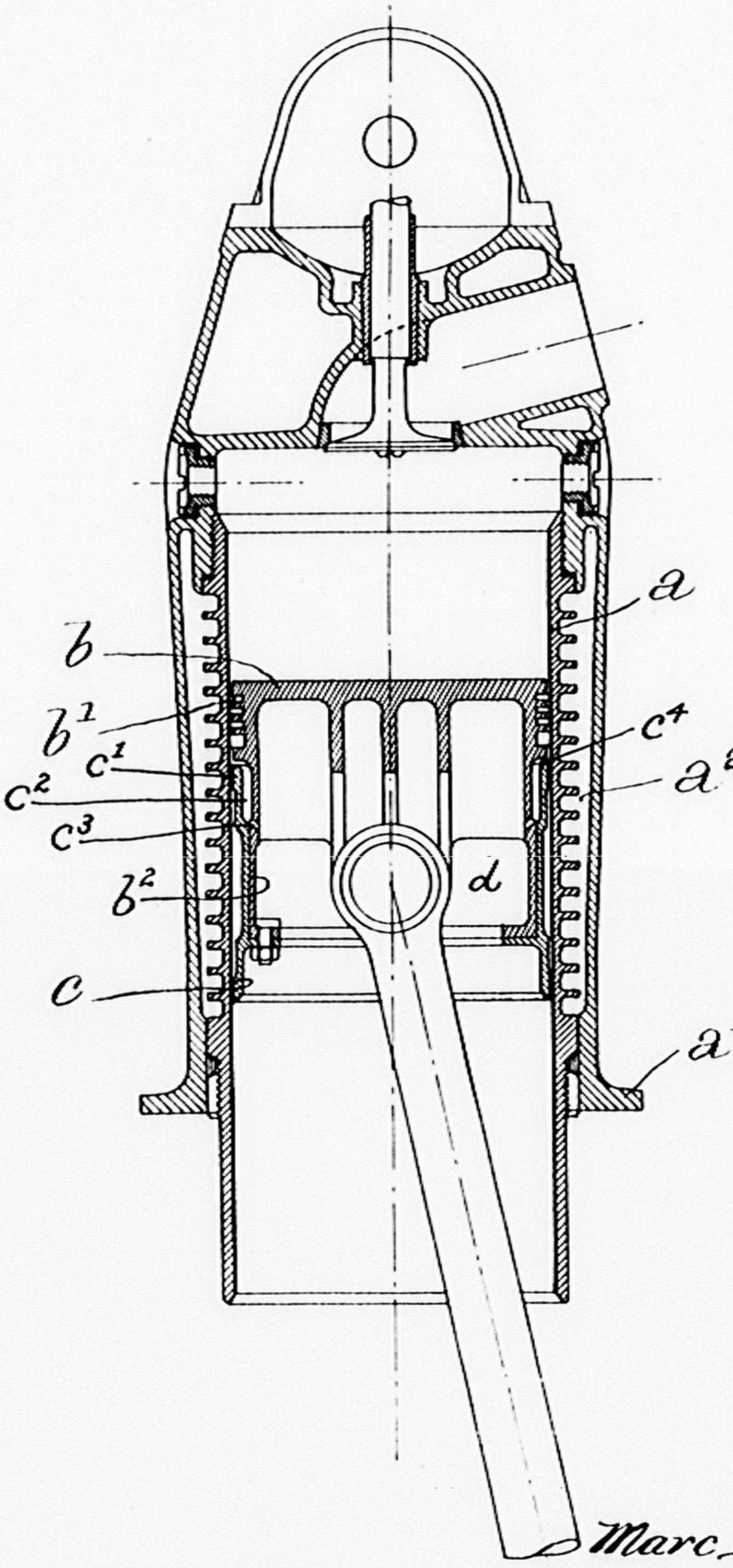
Witnesses:

Geo. H. Knight,
James H. Layman.

Dec. 12, 1933. M. BIRKIGT 1,938,566

PISTON AND CYLINDER ASSEMBLY

Filed July 15, 1927



Inventor
Marc Birkigt
By
Amos L. Norris
Attorney.

Patented Dec. 12, 1933 **1,938,566**

UNITED STATES PATENT OFFICE

1,938,566

PISTON AND CYLINDER ASSEMBLY

Marc Birkigt, Bois Colombes, France

Application July 15, 1927, Serial No. 206,114, and
in Belgium August 12, 1926

6 Claims. (Cl. 309—3)

The present invention relates to piston and cylinder assemblies and more particularly to those adapted for use in internal combustion engines.

One of the objects of the invention is to provide an assembly capable of withstanding long use without appreciable wear of the surfaces in frictional contact.

Further objects will appear in the course of the detailed description which will now be given with reference to the single figure of the accompanying drawing which shows a section through a cylinder and piston assembly constructed in accordance with the invention.

a is a cylindrical shell formed with proper reenforcing ribs and mounted inside a shell a'. Shells a and a' define a chamber a^2 capable of receiving a cooling fluid. Cylinder a is, preferably made of steel or similar nitridable material and has an internal surface which has been superficially hardened by treatment with a nitrogen-liberating material. The piston sliding in contact with cylinder a is, preferably, made in two parts; i. e., an upper non-frictional part b of aluminium, duralumin or similar light metal having annular piston ring recesses b^1 (the piston rings themselves are not shown) formed therein, and a skirt portion c, preferably of steel which has been surface hardened in the same or in a similar manner to cylinder a. It will be noted that skirt c has an external diameter corresponding to that of the cylinder only at each extremity and that the intermediate portions are of lesser diameter, so as to diminish the wear to a minimum.

As illustrated in the figure of the drawing, the head b has a reduced portion b^2 which fits snugly and telescopically within the skirt c. The upper part of the skirt c is flared somewhat, as at c^1, thereby forming with b^2 an annular chamber c^2 opening outwardly through an annular aperture c^4. Apertures c^3 provide communication between the annular chamber c^2 and the interior d of the piston.

In proceeding to construct the assembly above described, it is well to start with steel forgings or the like corresponding in form to the cylinder and the piston skirt and to machine each of the latter to a proper fit. The cylinder and the skirt may then be surface-hardened and then refinished to final working dimensions. Aluminium head b may be telescopically fitted into the skirt in the manner shown in the drawing or may be rigidly attached thereto in any other manner desired.

In operation it is found that the combination of two surface-hardened frictional surfaces reduces the frictional loss, permits high speed operation, reduces lubrication and wear, and, since metals ~~of equal coefficient of expansion~~ are used, minimizes piston "slap".

The present invention, in certain of its broader phases, as above indicated, includes in a piston and cylinder assembly the combination of two mutually contacting friction surfaces of which either one or both have a thin, hard, wear-resisting case or skin backed by softer metal, which skin is formed of ferrous metal that has been treated upon the wearing surface to incorporate with the metal thereof to an appreciable and effective depth nitrogen in the form of nitrides according to known nitriding processes, and particularly according to the process described in U. S. Patent No. 1,487,554.

What I claim is:—

1. In an internal combustion engine, a cylinder having a hardened wearing surface portion containing nitrogen in the nitride form.

2. In an internal combustion engine, a cylinder and a piston, having surface-hardened, mutually contacting friction surfaces containing nitrogen in nitride form.

3. In an internal combustion engine, a cylinder having a surface-hardened, wear-resisting ferrous metal surface such as may be produced by heating such surface in the presence of nascent nitrogen at about the peritectoidal transformation temperature of said metal.

4. An element of a piston and cylinder assembly for an internal combustion engine having a surface-hardened, wearing surface containing nitrogen in nitride form.

5. An element of a piston and cylinder assembly for an internal combustion engine having a surface-hardened, wear-resisting ferrous metal surface such as may be produced by heating such surface in the presence of nascent nitrogen at about the peritectoidal transformation temperature of said metal.

6. A piston and cylinder assembly for an internal combustion engine having surface-hardened mutually contacting, wear-resisting ferrous metal surfaces such as may be produced by heating such surfaces in the presence of nascent nitrogen at about the peritectoidal transformation temperature of said metal.

MARC BIRKIGT.

Endorsed on Cover: No. 7280. Abbott et al., Appellants, vs. Coe. United States Court of Appeals for the District of Columbia Filed Nov 10 1938 Joseph W. Stewart, Clerk

Judge Edg

UNITED STATES
COURT OF APPEALS FOR THE
DISTRICT OF COLUMBIA

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UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA.

No. 7280.

EDWARD J. ABBOTT
AND
ABBOTT MACHINE COMPANY,
Appellants,

v.

CONWAY P. COE, Commissioner of Patents,
Appellee.

BRIEF FOR APPELLANTS.

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UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA.

No. 7280.

EDWARD J. ABBOTT
AND
ABBOTT MACHINE COMPANY, APPELLANTS,
v.
CONWAY P. COE, COMMISSIONER OF PATENTS, APPELLEE,

BRIEF FOR APPELLANTS.

I. STATEMENT OF THE CASE.

This is an appeal from a final decree of the United States District Court for the District of Columbia dismissing a bill against the Commissioner of Patents to compel the issuance of Letters Patent under United States Code Title 35, Sec. 63, as amended [Sec. 4915 of the Revised Statutes (Com. Stat. Sec. 4960) as amended March 2, 1927 (44 Stat. L. 1325)].

The appellants are Edward J. Abbott, the applicant for patent, and his assignee, Abbott Machine Company.

There are three sets of claims in issue.

Two sets cover specific improvements of great value in stationary winding machines to wind cross-wound packages: (a) The first set (claims 8, 9, 10, 37 and 38; R. pp. 3 and 4) covering a case-hardened cam cylinder with crossed spiral grooves which eliminated the breakage of the sliders operated by the cam cylinder and in addition tripled the operating speed of such machines by reason of the unexpected and unobvious property of case-hardened metal of permitting a metal-to-metal contact at high speed with very sketchy lubrication; (b) a second set of claims (26 and 28; R. p. 4) covering an improved slider which is to be driven back and forth by the cam cylinder to lay the yarn on the package being wound, which is so constructed that for the first time high speed was made possible for appreciable periods of time without excessive vibration or binding of the slider.

The third set of claims (34, 35 and 36; R. p. 4) covers, generally a resilient and, specifically cork or rubber tires, for mounting on the high-speed case-hardened cylinder which make it possible to use the cylinder on automatic traveling machines at the high speed which it is capable of attaining on stationary machines.

All three improvments made possible automatic traveling machines.

The District Court in its Memorandum of Decision (R. pp. 9–10) agreed with the Board of Appeals of the Patent Office that the claims lacked patentable invention.

The Court ruled (Conclusion of Law No. 1, R. p. 13) that it was not invention in view of the prior art to case-harden a crossed grooved cam cylinder for a winding machine. The prior art showed the case-hardening of power transmission chain links and pistons and cylinders, in the latter case to reduce frictional wear at high speed operation. In so ruling the District Court was in error.

Frictional wear of the cam cylinder of a winding machine was not a limiting factor in securing the high speeds which the art had been seeking for over forty years, but the limiting factors were rather the throwing of oil from the revolving cam cylinder onto the yarn at high speed and breakage of the sliders. For over forty years those skilled in this art had been interested in mechanical contrivances, some to lessen the throwing of oil and others different in character to prevent slider breakage. The applicant cut at the root of both difficulties and solved both problems by case-hardening the cam cylinder itself. Case-hardening a cross-grooved cam cylinder of itself removed a cause of slider breakage hitherto unknown which the applicant discovered in his work.

The patentability of the case-hardened cam cylinders rests (1) on the fact that case-hardening was not in fact obvious to those skilled in the art, for the art waited forty years before the long-felt want for higher speeds was realized by what appears to be simple and obvious only after it is done; (2) on the utilization of case-hardened metal not to resist frictional wear, which the art does show, but to make possible the use of so little oil in the winding machine that the yarn will not be fouled at high speed which the art does not show; (3) on the discovery of a source of trouble in causing slider breakage not before known and the discovery and application of the remedy; and (4) on the new use for high-speed cam cylinders on automatic traveling winding machines.

The new slider is covered by claims 26 and 28. It is mounted to slide on one round rod and carries an extension to bear against the cover plate and prevent rotation of the slide on the round rod on which it is mounted. The Board of Appeals rejected the claims on a combination of references, some showing a slider mounted on round rods and another which was claimed to show a portion of the slider running in a slot in the cover. The Court ruled that it was not invention to mount the slider of a winding machine in the manner specified in these claims (Conclusion of Law No. 2, R. p. 13). In so ruling the District Court was in error.

The Court found that the applicant's slider made high speed possible without chattering or binding of the slider. The art had long sought to increase the speed of cross winding machines by changes in the slider. This was accomplished by the applicant by an ingenious selection and combination of individual elements old in the art with such structural changes as were necessary to make the combination.

The claims to the resilient driving tires for the cam cylinder were held to be unpatentable. The applicant, Abbott, had a prior patent on a slow-speed traveling winding machine (patent No. 1,700,425) in which he disclosed soft metal driving tires on the cam cylinder. The District Court held claim 34 (broadly covering a resilient tire) invalid as anticipated by this "soft metal" tire (Conclusion of Law No. 3, R. p. 13). This was error, as there is no evidence on this record that soft metal is resilient. The District Court further held that there was no invention in substituting rubber or cork for soft metal in view of the known characteristics of the material (Memorandum of Decision, R. pp. 9–10; Conclusion of Law No. 4, R. p. 13). This also was error. The applicant did not adopt either cork or rubber because of their known characteristics. The applicant desired a material that would grip a greasy driving roll at high speed while at the same time permitting endwise movement of the tire on the driving roll in the other direction. There was no evidence that resilient materials, broadly, or cork and rubber, specifically, had these contradictory characteristics or were known to have them.

II. ERRORS RELIED UPON.

The District Court erred in finding or ruling:

(1) That it is not invention in view of the prior art to case-harden a cam for a winding machine such as shown in the Abbott et al. patent No. 1,700,425 in the manner specified in claims 8, 9, 10, 37 and 38 in suit.

(2) That it is not invention to mount the slider of such a winding machine in the manner specified in claims 26 and 28 in suit.

(3) That claim 34 in suit is anticipated by the Abbott et al. patent No. 1,700,425.

(4) That it was not invention to substitute for the soft metal tire on the cam shown in said Abbott et al. patent a tire made of rubber or cork.

Summary of Detailed Argument.

III. Short Description of Applicant's New Machine.
IV. The Background of the Invention.
    (a) Stationary Winding Machines.
    (b) Traveling Winding Machines.
V. Advantages and Utility of the New Machine.
    (a) Practically No Lubrication.
    (b) No Slider Breakage.
    (c) Utility.
VI. The Case Hardened Cam Cylinder Claims.

VII. The Tire Claims.
VIII. The Slider Claims.
IX. Summary.

III. SHORT DESCRIPTION OF APPLICANT'S NEW MACHINE.

It is necessary in some cases and desirable in others in the textile industry to take the yarn as it comes from the maker of spun yarn and rewind it on different packages for different uses to which the original package cannot be put. Such machines make from the original package different kinds of rewound package for different uses. The applicant's machine is for making a particular kind of rewound package called a "cross-wound" package. Examples of cross-wound packages are plaintiff's physical Exhibits 5, 6 and 7. Winding machines to make these packages constitute from 30 to 50% of the entire winding machine field. They are the big mass production type of machine (R. p. 25).

The applicant's machine comprises a number of winding units. A side view of one such unit is shown in Fig. 2 (R. p. 75) and a front view in Fig. 6 (R. p. 77). Referring to Fig. 6 it will be seen that each unit carries a yarn supply bobbin 122^a (near the bottom of the figure) from which the yarn is to be rewound on the spindle 72 (near the top of the figure). The yarn is led from the supply bobbin to the rewinding spindle through the guide eye or notch 106 on the slider 101^a, which shuttles back and forth from one end of the rewinding spindle to the other laying the yarn on the package being wound. While the yarn is being so applied, the new package on the spindle 72 is caused to rotate.

This rotation of the package on spindle 72 is brought about by the surface-to-surface contact between it and a long rotating roll 50. The spindle 72 is so mounted as to swing away from the roll 50 to permit the package to grow outwardly. See Fig. 2 (R. p. 75) in which W indicates the partially wound package resting on the rotating roll 50 and being rotated by that roll. So much for the way in which the package itself is rotated.

The yarn is laid back and forth along the rotating package by the movement of the slider 101^a which carries the yarn guiding notch 106 (see Fig. 6, R. p. 77). The slider is attached to a boat-shaped dog or follower (105^a, Figs. 7, 7^a and 7^b, R. p. 77) which runs in the grooves of the cam cylinder 70. As the cam cylinder is made to rotate the dog and its attached slider are caused to follow the groove back forth and lay the yarn. The slider body 101^a is mounted on a round rod which permits it to be moved back and forth. It is kept from turning on the rod by an extension 101^c (Fig. 5, R. p. 75) which has a flat upper bearing surface and slides along the under face of a cover plate 110 (see Fig. 4, R. p. 75). The slider is light and compact and fits in the triangular space between the cam cylinder 70 and the cam 50 (see Fig. 4). The thread guide eye 106 is in this way brought close to the nip of the driving roll 50 and the package W (see Fig. 2, R. p. 75). It must be placed just as near to the nip of the rolls as possible to get a properly wound package without objectionable flanges (R. p. 43). The position of the slider in this space between the cam 70 and the package W permits the use of a short arm to carry the thread guide eye close to the nip of the rolls. Such a short arm is much less liable to snap and break off at high speeds when the slider and its arm reverse their movement at one end of the cam cylinder. To permit such a mounting of the slider it is necessary to have a small diameter cam cylinder, one that is materially less in diameter than the width of the package being wound. The use of such a small diameter cam cylinder was made possible, as will be pointed out later, by the expedient of case hardening it in the vicinity of the groove.

The cam cylinder 70 is itself made to rotate by the rotating roll 50 which it will be remembered also drives the package being rewound. On each end of the cam cylinder is a resilient tire, preferably of cork or rubber, which comes in contact with the roll 50. As the roll 50 turns, the tires and the cam cylinder on which they are fixed also turn, and as the cam cylinder turns, the slider with its guiding notch is driven back and forth to lay the yarn. A complete winding unit was admitted in evidence as Plaintiffs' Exhibit 8 (physical).

These winding units could be stationary and disposed along a rotating roll 50. In the preferred embodiment of the applicant they are, however, parts of an automatic traveling machine. Each individual winding unit, such as has been described, is attached to a chain driven by horizontal sprocket wheels at each end of the machine (see Fig. 1, R. p. 73, which is a plan view of the whole machine). On this figure the chain is indicated by the numeral 30 and two winding units are indicated by the numerals 10. The long rotating roll 50 is on the right of the machine and a corresponding roll 51 on the left. As the units are moved around the machine by the chain they are dragged along these rotating rolls 50 and 51. The packages being made on each unit remain in contact with these rolls and are rotated by them. The cam cylinder of each unit is also rotated as it goes around the machine, by contact between its tires and the rotating rolls as has been described. It is at this point that the tires become especially important. While these cam cylinders are being dragged along the rotating roll their tires are necessarily traveling endwise on that roll 50 and at the same time they must not lose their adhesive grip on the roll in any appreciable amount. If the driving grip were impaired there would be slip between the roll 50 and the cam cylinder which could not be driven at high speed.

The machine described will rewind yarn at the rate of 750 yards per minute, which is triple that of the fastest cross winding machines of the prior art, whether stationary or traveling (Findings of Fact 4 and 6, R. pp. 10–11). Something has happened in the practical art as a result of the applicant's work.

IV. THE BACKGROUND OF THE INVENTION.

(a) Stationary Machines.

Crossed spirally-grooved cam cylinders were known in stationary cross-winding machines before 1900. Foster patent No. 459,039 (R. pp. 81–85); Foster patent No. 437,417 (R. pp. 87–90); Foster patent No. 499,668 (R. pp. 91–94). This is admitted by the appellants for they themselves put in evidence some of the patents showing them.

Nothing is added to the case, in view of this admission, by such patents as Rhoades No. 867,153, dated September 24, 1907 (R. pp. 129–133), showing such cylinders on a slow-speed balling machine (Fact Findings Nos. 14 and 16, R. pp. 12–13); or the British patent No. 585,198, dated June 29, 1897 (R. pp. 95–100), for slow traverse and slow speed spooling machine (Fact Finding No. 14, R. p. 12).

Such cam cylinders had ceased to be used commercially before 1910. The applicant Abbott has been familiar with winding machines including those of the Foster Machine Company, since 1910 (R. pp. 20–21) and has never seen a machine with crossed spiral grooves in the cam cylinder (R. p. 24).

They disappeared from the patented art before 1897. The Foster patent No. 585,198, dated June 29, 1897 (R. pp. 95–100), shows the reason. It appears at this time that these machines had reached their maximum speed by increasing the diameter of the cam cylinder (lines 76–90, R. p. 98). With large cylinders a single groove will do (see Fig. 3, R. p. 96). It also appears from this patent that higher speeds were not considered practical because of slider breakage (lines 76–80, R. p. 98). There was also oil trouble which was causing concern. In this patent (Fig. 1, R. p. 95) the package is not driven by contact with the cam cylinder but with an intermediate roll S. There is the usual slider but in this patent it runs in a very deep groove in the cam cylinder, the groove being provided with oil pockets a^6 (see Figs. 3 and 4, R. p. 96) to permit lubrication. Heretofore this had been impossible. "In the old form of drum the traveler could not be oiled because the oil escaped to the outside of the drum and was taken up on the winding rolls lying against the drum and was put by it onto the yarn or thread, soiling it" (lines 21–26, R. p. 99).

There are also shown springs or buffers (Fig. 5, R. p. 96) to absorb the shock of the slider at the point of reversal of its movement.

From an inspection of Fig. 1 on R. page 95 it is apparent that the slider must have a very long goose neck indeed to curve up around the intermediate driving roll S and present the thread to the nip of that roll and the package t^4 (shown in dotted lines). Such a long goose neck would be cracked like a whip at the points of reversal of movement and would break off very easily.

The appellants desire the Court to note particularly at this point the large cam cylinder over a foot in diameter (lines 88–90, R. p. 98); the single groove; the buffers to prevent slider breakage, and the deep groove which permitted oiling. Case-hardening was known prior to 1897. It did not occur to Foster or the Foster Machine Company, both highly skilled in this art, that the increase in speed which they were attempting to get could be secured without elaborate devices for lubricating the slider follower as it slid in the groove, and without slider breakage. It did not occur to them that these objects could be secured by retaining the small crossed spirally grooved cams and case hardening them in the vicinity of the grooves. They abandoned those crossed spiral entirely and went instead to larger cylinders, special devices to permit oiling, and buffers to take the shock of the sliders at the ends of the stroke.

Various changes have been made in the Foster machine since 1897, but the machine of this patent No. 585,198 is substantially the machine shown in patent No. 716,923 (see Fig. 1, R. p. 115) which is the commercial machine of the Foster Machine Company (R. p. 18). The applicant Abbott has been familiar with the Foster machine since 1910 (R. pp. 20–21).

We have referred to the long goose neck on the slider at the end of which is the guide eye or notch for presenting the thread to the package being wound. This obviously would be a structure that could break very easily. The next Foster patent shows an attempt to get around the difficulty by making this whole slider or thread guide in skeleton form to make it very light. See patent No. 655,616 (Fig. 1, R. p. 102) and the slider description on page 3 of the patent, lines 4–17 (R. p. 107). By this time the deep cam groove had been abandoned. Another change made was to prevent fouling of the yarn by the oil used in lubrication. This change is shown in the Foster patent No. 655,617, dated August 7, 1900

(R. pp. 109–114). This patent was also put in by the appellants. It shows (Fig. 1, R. p. 109) the large hollow cam cylinder with the single groove, the slider driven by the cam cylinder, and an intermediate roll which drives the package. The change made in this patent was to provide the intermediate package-driving roll M (Fig. 2, R. p. 110) with independent driving connections. Theretofore this roll had been driven by surface contact with the cam cylinder itself. This expedient of driving the intermediate roll independently was taken to prevent fouling of the yarn with oil. As said on page 1 of the patent in lines 43 to 47 (R. p. 112):

> "To obviate any possibility of the yarn being soiled by oil from the drum or from the driving roller I have herein provided to rotate the driving rollers independently of the drums. . . ."

Again the appellants desire the Court to note the expedients adopted to prevent fouling the yarn, which grow more and more complicated. There is now an independent driving connection for an intermediate package-driving roll. We desire the Court also to note that the use of an intermediate driving roll and a large cam cylinder requires the long arm or goose neck to extend from the follower in the cam groove around the intermediate roll and be close to the nip of the package and the package-driving roll. This is shown in Fig. 2 (R. p. 110) by the reference numeral 4. It is better shown in McKean patents No. 716,923, dated December 30, 1902 (see numeral 14, Fig. 1, R. p. 115), and No. 952,015, dated March 15, 1910 (see reference numeral 20, Figs. 1 and 2; R. pp. 135–136). None of these Foster Machine Company machines could wind at a faster rate than 250 yards per minute, which has been the accepted speed for such machines for thirty years prior to the applicant (Finding of Fact No. 4; R. p. 10).

The persistent attempts of those skilled in the art to increase speed by lubricating a cam groove without getting any oil on the package is further illustrated by a British patent to Voight No. 2102 of 1901 (R. pp. 184–185). In that patent there is shown a slider engaging a spiral cam wheel *k*, both the slider and the cam wheel being completely enclosed in a casing to permit a maximum of lubrication without danger of fouling the yarn. A small flat extension of the slider projected through a slot in the casing and carried at its outer end the guide eye or notch for the yarn.

The efforts of the prior art to increase speed were towards changes in the actual structure of the parts of the machine to permit additional lubrication and to minimize slider breakage. The applicant has done away with lubrication except for such small amounts as would not be thrown off the cam cylinder in its revolution even at speeds which have tripled that of the prior art. He was able to do this by reason of the case-hardened grooves in the cam cylinder. He has also avoided all the elaborate contrivances to prevent slider breakage, and he has done this as a result of case hardening the cam cylinder.

The maximum speed of any cross winding machines prior to the applicant was about 250 yards per minute. It was the opinion of those most highly skilled in this art that no higher speed could be attained without inventing a new motion. The opinion of the art is illustrated in a standard work "The Principles of Worsted Spinning" by Howard Priestly, Longmans Green & Company, 1921.

> "For yarn which would wind at 1200 feet per minute (400 yards) it is obvious that the bar would have to move at a speed of 170 feet per minute and reverse its motion instantaneously 400 times in doing so. *As yet no motion has been found which will stand this strain for any length of time,* and most quick traverse machines cannot compete where speed alone is the desideratum; but there are several of them which do good work at more than half that speed (200 yards)." (R. pp. 31–32). [Matter in parentheses is ours.] [Italics ours.]

Those skilled in this art as represented by Mr. Priestly were in fact wrong. The applicant has tripled the speed of the stationary machines of the prior art not by inventing a new motion but by resurrecting the small crossed, spirally grooved cam cylinders of the prior art abandoned since a time prior to 1900 and *case-hardening the grooves.*

(b) Traveling Machines.

The stationary machines described preceded the automatic traveling winding machine invented by the present applicant and William G. Abbott, Jr. which is shown in patent No. 1,700,425 (Finding of Fact No. 4, R. pp. 10–11). There are a great many automatic features of that machine which are not relevant to any question raised in this case. It is shown in plan view in Fig. 1 (R. p. 143) and an individual winding unit is shown at Fig. 4 (R. p. 145). It will be apparent from these figures alone that the machine of this earlier patent is quite like the machine shown in the application involved in this case but without the features covered by the claims now on appeal. It is a slow speed machine winding at a rate of less than 250 yards per minute (Fact Finding No. 4, R. p. 10), which is in fact slower than the accepted speed of 250 yards per minute for the stationary machines. As shown in the patent the machines are of limited practical use because of their slow speed which made it necessary to have large unwieldy machines. The applicant undertook experimental work to improve the speed of winding. This he in fact did by the three improvements: The improved cam cylinder is inherently capable of high speed operation in any winding machine, stationary or traveling; the slider makes high speed possible in any winding machine without chattering or binding of the slider; and the tires make it possible to use the cam and its associated slider to the optimun advantage in a traveling machine. All three developments in fact contributed to the perfection of the machine shown in the patent, and the Court so found (Finding of Fact No. 6, R. p. 11).

The tripling of speed made the machines commercially practical (R. p. 41). They were the first automatic traveling machines on the market because the applicant was the first to reach the high winding speed necessary to make such machines feasible.

They are over 80 feet long and have up to 180 spindles. They are attended by only one operator who sits at one end of the machine (R. p. 41; see first page of red booklet "Abbott Winders", Plaintiffs' Exhibit 13—Physical—). The machines made possible in the cross-wound package art the continuous principle of the assembly line. It is a new winding machine—a pioneer development—which has been made practically feasible by the improvements in issue.

V. ADVANTAGES AND UTILITY OF THE NEW MACHINE.

(a) Practically No Lubrication.

Any appreciable amount of oil would be thrown out of the grooves of the rapidly revolving cam and onto the yarn. Case-hardening permits high speed operation which is triple that of the prior art with only a sketchy lubrication (almost dry) which will not foul the yarn (R. pp. 41–42). This is the great advance over the prior art.

Oil thrown more from small cam than large

(b) No Slider Breakage.

Sliders may break either at the neck or arm which carries the yarn guide eye or notch, or at the follower which runs in the cam groove. The prior art attributed all slider breakage to the shock of reversal of movement at the end of each stroke and therefore used buffers to absorb the shock (Finding of Fact No. 5, R. p. 11).

With regard to slider breakage at the follower on machines using crossed spirally-grooved cam cylinders, this idea of the cause of slider breakage was wrong. The applicant found that it was due to the very slight crumbling of the frog points due to the repeated impacts of the followers. This crumbling lengthened the gap that the follower had to jump. When the gap was lengthened the follower did not slide smoothly from one groove to the other but began to hammer on the point and finally to break (R. p. 38; Fact Finding No. 7, R. pp 11). Case-hardening the metal of the groove will prevent the crumbling of the frog points. Case-hardening to prevent excessive wearing away from frictional sliding contacts was known prior to the applicant, but there is nothing in the record to show any appreciation of the fact that case-hardening would prevent actual crumbling due to short sharp impacts.

Case-hardening therefore permitted the use of crossed spirally-grooved cam cylinders without excessive breakage of sliders at the followers. With crossed spirals the cam cylinder can be made smaller (R. p. 23). Case-hardening therefore permitted the use of small cylinders at high winding speeds.

With small cam cylinders it is possible to employ small sliders, whether of the applicant's preferred construction or otherwise, which will fit in the space between the cam cylinder and the package being wound, and which need not have any long goose neck such as is shown in the McKean patents No. 716,923 (numeral 14, Fig. 1, R. p. 115) and No. 952,015 (numeral 20, Fig. 1, R. p. 135; Fig. 2, R. p. 136). The applicant's light compact sliders will not break at the points of reversal of momement (R. p. 43).

(c) Utility.

As a result of the applicant's work the winding speed of both stationary and traveling machines has been increased from 250 yards to 750 yards per minute (see Fact Findings Nos. 4 and 6, R. pp. 10–11).

The speed of stationary machines has been tripled by the use of small case-hardened cams. The Foster Machine Company is the oldest and best established firm making cross-winding machines. It is also one of the largest firms. Since the applicant's invention this company has abandoned the large cast-iron single groove cams which were characteristic of their winders for thirty years or more and has adopted a small diameter hardened-steel cam with a slider quite similar to the cam and slider of the applicant (R. p. 47; Finding of Fact No. 12, R. p. 12). The new case-hardened cam cylinders have therefore to a great extent displaced the unhardened ones of the prior art.

The application of the assembly line principle in this industry by the use of traveling automatic machines was made possible by the increase in speed secured by the applicant, which increase was due, as the Court found, to all three improvements in issue (Finding of Fact No. 6, R. p. 11). The Abbott Machine Company's automatic winders with a winding speed of anywhere from 600 to 750 yards per minute, are 80 feet long and are tended by one girl. If the company had been restricted to the old commonly accepted winding speed of 250 yards per minute, it could not have put the winders in a mill for they would have had to be too long. The Abbott Machine Company could not have utilized the advantages of moving spindles, especially the automatic features that are put on the winders (R. p. 41).

The automatic traveling machines of the Abbott Machine Company have enjoyed a great commercial success. Over 300 such machines have been built and in 1937 the Abbott Machine Company had about 25% of the business of making and selling cross winding machines, which is the big mass production type of machine (R. pp. 25, 47; Finding of Fact No. 11, R. p. 12). Some of the large users of the Abbott machines are named and typical installations shown in plaintiffs' Exhibits numbered 12 and 13 (Physical).

VI. THE CASE-HARDENED CAM CYLINDER CLAIMS.

The District Court found facts from which the unobviousness of case-hardening cams in winding machines logically follows as a necessary inference.

For thirty years a speed of 250 yards per minute had been the accepted speed (Fact Finding No. 4, R. p. 10).

Wear of the grooves was never a factor. The Abbott Machine Company bought six Foster machines from 1910 to 1912 and ran them for fifteen years (R. p. 21). Damage to the grooves was never severe because the crucial point was always passed first due to breakage of the dogs or breaking off of these goose necks. Any faster speed would have thrown grease on the intermediate driving roll and from there it would have gotten onto the package which was being driven in contact with that intermediate roll (R. p. 24). The prior art therefore was never able, due to these two facts, to run the machines fast enough to cause appreciable wear in the grooves.

250 yards per minute had been the accepted speed and at this speed there is no appreciable wear on the parts (Fact Finding No. 4, R. pp. 10–11).

The factors that did limit the speed were the throwing of oil and the breakage of the sliders which those most highly skilled in the art tried to correct by various mechanical contrivances (Fact Finding No. 5, R. p. 11). The applicant departed from the teaching of the prior art. He adopted the small cam cylinders of the art which had been abandoned prior to 1900 and case-hardened the crossed grooves. This made high speed possible with so little lubrication that there would be practically no fouling of the yarn in a winding machine and also eliminated slider breakage (Fact Findings Nos. 7 and 8, R. p. 11).

The applicant has accomplished an increase in efficiency and a decided saving in the operation of stationary machines. Further the new high-speed cam cylinder has a new use, for it can be used on automatic traveling machines which require much higher speeds than the accepted speed of 250 yards per minute for stationary machines (R. p. 41). He has done all this by departing from the recommendations of those most highly skilled in the art. The writer of a standard textbook, Mr. Howard Priestly, thought that speeds higher than 200 yards per minute could not be attained until a new motion had been found which would stand the strain of 400 reversals in motion per minute. The applicant succeeded, not by devising a new motion, but by case-hardening the old abandoned crossed spirally-grooved cylinders.

The applicant did something that was not in fact obvious to those skilled in the art, for they did not in fact do it. Every suggestion is in the art but the right one. A change for which the art has long waited and striven to secure in other directions could not have been obvious in fact

Paramount Publix Corp. v. *American Tri-Ergon Corp.,* 294 U. S. 464, at p. 474:

> "Where the method or device satisfies an old and recognized

> want, invention is to be inferred, rather than the exercise of mechanical skill. For mere skill of the art would normally have been called into action by the generally known want."

Potts Co. v. *Creager*, 155 U. S. 597, at p. 608:

> ". . . but the decisive answer is that with dozens and perhaps hundreds of others laboring in the same field it had never occurred to anyone before."

Disregarding the evidence from which unobviousness in fact is a necessary and logical inference, the Court ruled that it was not invention to case-harden a crossed spirally-grooved cam cylinder in a winding machine (Conclusion of Law No. 1, R. p. 13).

The Court found that it has long been known that the wear-resistance of a metal can be increased by a process of case-hardening and referred to two patents, one showing a power transmission chain in which the bearing faces of the links have been case-hardened, and the other a piston and cylinder in which the contacting faces have been case-hardened to permit high-speed operation with less wear due to friction (Fact Finding No. 13, R. p. 12).

It has been pointed out, however, that wear of the grooves was not a factor in any winding machine.

The general properties of case-hardened metal were known but there is no suggestion in either patent referred to in Fact Finding No. 13 that friction could be so reduced by case-hardening to permit contacting metal faces to be run practically dry in any kind of an apparatus. There is no suggestion that case-hardening a cam groove in a winding machine would permit high-speed operation with so little lubrication that the yarn would not be fouled.

In fact the use of case-hardened metal for the cams of winding machines had long been overlooked. When the substitution was made the result was an increase in speed which tripled the efficiency of stationary machines and was one factor in making possible the new automatic traveling machines. Within the governing decisions of this Court, a patent should be issued containing claims to the case-hardened spirally-grooved cam cylinders.

Carbide & Carbon Chemicals Corp. et al v. *Coe,* 40 USPQ 141—(Not yet reported in the Official Reports or the Federal Reporter). 69 App. D.C. 372

In this case the application disclosed the use of a metallic food package coated with vinyl resin on the side in contact with the contents. The general properties of vinyl resins were unknown. In the instant case, as in the cited case, there was substitution of material which resulted in new and useful results.

Gasoline Products Co. v. *Coe,* 66 App. D. C. 333.

In this case the application disclosed a cracking coil of chromium alloy to resist sulphur corrosion. In the instant case, as in the cited case, there was substitution of material which resulted in new and useful results, an increase in efficiency, and a saving in operation.

The argument for patentability in the instant case is, however, made stronger by the fact that in substituting case-hardened for unhardened metal, especially in the frog points, the applicant was not using the generally known properties of case-hardened metal but was in fact using a property the existence of which had been denied.

There is no suggestion in the prior art that a thin, case-hardened frog point in any kind of an apparatus would be able to stand impacts without crumbling. Indeed, the reverse is the case. Muller's patent No. 1,511,764, which covers the case-hardened bearing face of a power transmission chain link, definitely states that case-hardening results in brittleness (R. p. 193 lines 18–22). It was to be expected that a brittle frog-point would crumble all the more when subjected to sudden sharp impacts. The applicant found that this was not so and that the frog points stood up in use.

It is invention to substitute a material to make use of a property which is not recognized by the art.

Gasoline Products Co. v. *Coe, supra.*

Re Saul etc, 102 F 2d 232

In this case the ability of the chromium alloy to resist sulphur corrosion was not known specifically.

> See also *Westmoreland Specialty Co.* v. *Hogan*, 167 Fed. 327 (C. C. A. 3).

The patent in this case covered a celluloid cap for salt shakers. The principal advantage of such a cap was that it kept the salt dry due to the insulating capacity of celluloid, which had not theretofore been recognized. The patent was held valid, although celluloid caps had been previously used on talcum powder bottles, but the advantages of the cap on a salt shaker were not involved in the use of such a cap on a talcum bottle.

A fortiorari it is invention to use a property the existence of which has been denied in the Muller patent.

> *The Mathieson Alkali Works, Inc.* v. *Coe*, 99 F. (2d) 443 —(Not yet reported in Official Reports). 69 App D.C 210

In this case the art had taught that cellulose would be damaged if bleached with hypochlorite in acid solution. The applicant used chlorite in acid solution and thereby flew in the face of any teaching that might be found in the prior art.

> *Carbide & Carbon Chemicals Corp.* v. *Coe, supra.*

The prior art in the cited case taught that the adhesion of vinyl resin to metal could only be secured by the use of a highly poisonous compound which would make it dangerous to use metal so coated in packaged food. The applicant in that case found that good adhesion could be secured without the use of the material which the prior art had considered necessary.

The District Court was further in error in not giving the well-recognized legal effect to its fact finding that slider breakage was conceded by the prior art to be due to shock at the point of reversal movement (Finding of Fact No. 5, R. p. 11) and that the applicant discovered that such breakage was not due to shock or reversal of movement but to the lengthening of the gap across which the slider had to jump due to the crumbling of the frog points (Finding of Fact No. 7, R. p. 11).

Gasoline Products Co. v. *Coe, supra,* at page 339:

> "Discovery of the source of trouble not before known and the discovery and the application of a remedy are well recognized as invention."

VII. THE TIRE CLAIMS.

Driving tires of soft metal on the cam slider of a slow-speed traveling winding machine were old in the present applicant's own prior patent No. 1,700,425. The Court below held claim 34, covering resilient tires, anticipated by this patent. This was error. There is no evidence that soft metal is resilient. There is no evidence that soft metal tires will grip in rotation while permitting endwise movement.

The Court ruled that it was not invention to substitute for the soft metal tire one made of rubber or cork (Conclusion of Law No. 4, R. p. 13) in view of the known characteristics of the materials (Memorandum of Decision, R. p. 10). This was error.

The long rolls 50 and 51 of the machine of the application in suit (Fig. 1, R. p. 73) acquire a slight film of the oil, such as olive, castor or peanut oil, which is used to lubricate the fibers in spinning. Cork has the property of absorbing this oil and retaining its driving grip on the roll and at the same time polishing or cleaning the roll (R. pp. 35, 36, 43). Nowhere in the prior art is there any suggestion that cork has these properties. Indeed, there is no patent introduced in evidence to show the use of cork as a friction driving material. Claim 35, therefore, covering driving tires of cork, is clearly patentable, for the applicant, in using this material, is not using any of its known properties. It was not known that cork would clean and polish a metal roll and at the same time maintain its driving grip.

Carbide & Carbon Chemicals Corp. v. *Coe, supra.*

It was not known that vinyl resin would adhere as such to metal without the use of tetraethyl lead, which is a poison.

Gasoline Products Co. v. *Coe, supra.*

In this case the prior art did not teach the resistance of the chromium alloy to sulphur corrosion.

Claims 34, 35 and 36 are patentable for another reason. Claim 34, it will be remembered, covers broadly a resilient tire, and claim 36 covers specifically a rubber tire.

It will be remembered that the winding units, including the cam cylinders, are dragged endwise along the rolls 50 and 51 (Fig. 1, R. p. 73) and that therefore the tires on the cam cylinders must be able to travel endwise while at the same time maintaining their driving grip for rotation in the other direction. Some form of soft resilient tire, such as cork or rubber, has good enough adhesion to revolve the cam and at the same time offers very little resistance when the winding units are moved around the machine. The reason for that seems to be that the material itself would be capable of flexing and letting the whole winding unit move slightly ahead while maintaining good adhesive contact without slippage at the contact points of the tire of the tractor roll. The endwise movement is quite small, about 1/200 of an inch for each revolution of the roll (R. p. 35).

This ability to grip in rotation and move endwise along a roll was not a known characteristic of either cork or rubber or any other resilient material. Neither patent in the record showing a rubber friction drive (Rowley No. 72, 087 and Stevens No. 1,566,704) shows this property (see Findings of Fact No. 18, R. p. 13). Indeed, the possibility of having a good grip while rotating and at the same time having endwise travel was not to be expected, because slippage necessarily involves loss of adhesion. For example, a locomotive tire that is slipping has lost its adhesion to the rail (R. p. 36).

All of the tire claims, therefore (34, 35 and 36), are patentable on the authority of

Carbide & Carbon Chemicals Corp. v. *Coe, supra.*
Gasoline Products Co. v. *Coe, supra.*

VIII. THE SLIDER CLAIMS.

Claims 26 and 28 relate to a slider mounted for endwise movement on one round rod and kept from turning on that rod by the cover plate. The Court below found that this construction makes high speed possible without chattering or binding of the slider (Finding of Fact No. 9, R. p. 11). The Court ruled that it was not invention to mount the slider in the manner specified in the claims (Conclusion of Law No. 2, R. p. 13).

The machine of the patent No. 1,700,425 had two round rods that ran right across the top of the cam, and on those rods was a slider sliding on one rod and being guided from revolving by the other. The packages that were wound were fairly good but needed improvement. The most vital objection was with the slider (R. p. 34).

As a result of further experiments, the applicant decided that it would be of great advantage to get the slider down in the small triangular space between the cam and the tractor roll. There was not room enough in this space for two rods of sufficiently large diameter. The applicant found that he could use one rod and then use the cover plate, which ran close over the slider, as the guide to keep the slider from turning on the rod.

The Foster patent No. 459,039 (see Fig. 6, R. p. 82) shows a slider mounted on two round rods. Such a construction is impractical, as a slider mounted on two round rods would jam in use if an attempt were made to wind faster than a rate of 250 yards per minute (Finding of Fact No. 15, R. p. 12).

The Rhoades patent No. 867,153 (see Figs. 1 and 2, R. pp. 130 and 129, respectively) shows a slow-speed ball warper and the slider element mounted on one round rod. It is prevented from rotating on the round rod by an extension in back and by the slider dog in front. The Rhoades machine was a very slow-speed machine, winding from 50 to 60 yards per minute. This particular construction is so heavy that it could not be run at speeds such as employed in winders (Finding of Fact No. 16, R. pp. 12–13).

The object of Voigt, the patentee of British patent No. 2102 of 1901 (R. pp. 184–185) was to increase the speed of cross winding machines firstly by constructing a slider to permit higher winding speeds, and secondly by enclosing the slider and cylinder in a case permitting free lubrication. His slider is a T-shaped one running in two slots in the casing which are at right angles to each other. The slider is not mounted on a rod but is supported directly in the slots. This slider could not be operated at winding speeds more than 250 yards per minute, because it would jam badly (Finding of Fact No. 17, R. p. 13).

Although the applicant is chargeable under the law with knowledge of the prior art, it will be apparent that the suggestions he may be presumed to have had from the cited patents were unrelated and were severally impracticable for the applicant's purpose. Foster and Voigt suggested quite different constructions that were only related by the fact that they both would jam if high speed were applied. Rhoades had a still different construction too heavy for use in a winder. The prior art is very old.

By devising a new combination set forth in claims 26 and 28, the appellant achieved a new result of rendering high speed possible without chattering or binding of the slider. By looking back one can pick out from the prior patents, *elements* of this combination, but the combination and the result are novel with the appellant.

Lucke v. *Coe*, 63 App. D. C. 61, at page 65:

> "It is comparatively easy, now that the Lucke device is in evidence, to take this and that from the references and achieve a *nunc pro tunc* solution of the problems confronting Lucke when he made his invention."

National Hollow Brake-Beam Co. v. *Interchangeable Brake-Beam Co.*, (C. C. A. 8), 106 Fed. 693, at page 706:

> ". . . a new combination of old elements, whereby a new and useful result is produced, or an old result is attained is a more facile, economical, and efficient way, may be protected by patent as securely as a new machine or composition of matter. *Seymour* v. *Osborn,* 11 Wall. 516, 542, 548, 20 L. Ed. 33; *Gould* v. *Rees,* 15 Wall. 187, 189, 21 L. Ed. 39."

IX. SUMMARY.

The winding machines referred to in this brief comprise that type of machine which may be described as constant winding speed headless cheese winders with sliders. These machines constitute probably 30% to 50% of all winding machines and are the big mass production type (R. p. 25). Cross-wound packages, referred to in this brief, are cross-wound headless cheeses like plaintiffs' Exhibits 5, 6 and 7 (Physical).

It is submitted that the patentability of claims 8, 9, 10, 37 and 38 (R. pp. 3–4) is supported (a) by the increase in efficiency and saving in operation, by tripling the speed of stationary winding machines of this big mass production type, which is due to the crossed spirally-grooved cam cylinders case-hardened in the vicinity of the groove, and (b) by the highly valuable advance made in the winding industry by the introduction into it of automatic traveling machines of this mass production type, which machines such cam cylinders helped to make possible.

It is submitted that claims 34, 35 and 36 (R. p. 4), covering the driving tires for cam cylinders in an automatic machine, are patentable for the reason that the applicant used unknown and unexpected properties of resilient material generally and of cork and rubber specifically as one factor making high-speed automatic traveling machines possible.

It is submitted that the patentability of claims 26 and 28 (R. p. 4) is supported (a) by the fact that this combination makes possible high speed in a winding machine of the type referred to without chattering or binding of the slider, a result long sought by the art, and (b) by the important part this slider construction played in making automatic traveling machines of this type possible.

Respectfully submitted,

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February 9, 1939.

UNITED STATES
COURT OF APPEALS FOR THE
DISTRICT OF COLUMBIA

FILED MAR 4 - 1939

Joseph W. Stewart

CLERK

No. 7280

In the United States Court of Appeals for the District of Columbia

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APPELLANTS

vs.

Conway P. Coe, Commissioner of Patents,
APPELLEE

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

BRIEF FOR THE COMMISSIONER OF PATENTS

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APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

BRIEF FOR THE COMMISSIONER OF PATENTS

This is an appeal from a decree of the lower court (R. p. 14) dismissing a bill brought by appellants under the provisions of Section 4915 R. S. (U. S. C., title 35, sec. 63).

By that bill it was sought to have the Commissioner of Patents issue to the Abbott Machine Company, as assignee of Edward J. Abbott, a patent on the Edward J. Abbott application No. 506,530, filed January 5, 1931, containing claims numbered 8, 9, 10, 26, 28, 34, 35, 36, 37, and 38.

The disclosure of the Abbott application in suit relates to a winding machine and specifically to certain alleged improvements over the apparatus shown in patent No. 1700,425, issued on an application of Edward J. Abbott and another.

The said Abbott patent discloses a winding machine of what has been referred to as the "race course" type in which winding mechanisms are moved in a substantially elliptical path and each of these mechanisms contains a rotatable cylindrical cam which has tires thereon made of soft metal and contacting with the driving roll at each side of the machine.

As shown in the patent, the machine is provided with two sprocket wheels about which passes a sprocket chain and the winding mechanisms are adapted to be carried around by the movement of this chain. As they move the tires on the cam come into contact with the driving roll which is caused to revolve. That cam roll is provided with a groove which crosses itself at least once and into which a slider fits. This slider carries a yarn guide and is caused to reciprocate back and forth by the movement of the cam cylinder so as to lay the yarn properly as it is being wound.

The claims relate to three different alleged improvements. The first group of claims, numbers 8, 9, 10, 37, and 38, relate to the case hardening of the cam cylinder with the crossed spiral grooves, and of these, claims 8 and 37 are illustrative:

> 8. A winding machine traverse device for laying a winding strand into layers of reversed spiral windings, including a rotary

> cylinder having a traversing groove therein, the groove including right and left hand spiral portions crossing each other at least once, said cylinder being of steel case-hardened in the region of the said groove.
>
> 37. A winding machine traverse device including a traverse guide and a cam follower connected thereto, and a rotary cam adapted to reciprocate the follower, said cam having a groove in the form of connected right and left-hand spiral portions having the relatively steep pitch and rapid reversal of direction adapted for cross-winding traversing by said guide, said right and left-hand spiral portions crossing each other at least once, and the cam being of steel case-hardened in the region of the said groove.

Claims 26 and 28 relate to the slider mounted upon a rod and having a cover plate, shown in Fig. 3 of the drawing, marked 110, and so arranged as to prevent tipping of the slider. Of these claims, claim 28 is illustrative:

> 28. In a winding machine for yarn and the like, the combination of a cylindrical traverse cam, a slider including a dog engageable with the cam surface of the cam to be traversed to and fro thereby, a round rod upon which the slider is adapted to slide, and a cover plate for the cam positioned to guide the slider as the latter is traversed.

The third group includes claims 34, 35, and 36, and relates to the resilient tires on the cam cylinder. In the Abbott patent this cam is stated to be made of soft metal. In the application in suit it is said to be resilient and made of either cork or rubber. Claim 34, which reads as follows, is broadly to a resilient tire while the other two claims specify, respectively, that the tire is made of rubber and of cork.

> 34. A textile machine comprising a traverse cam, a tractor roll for driving the cam, and a resilient tire on the cam adapted to contact with the tractor roll.

The first group of claims was held to be unpatentable in that it was not invention, in view of the prior art, to case-harden the cam cylinder in the region of the grooves thereon.

It will be noted that, as shown in Fig. 3 of the application in suit (R. p. 75), and in Fig. 4 of the Abbott et al. patent (R. p. 145), there are certain points formed by the crossing of the groove on itself. According to the testimony, when it was attempted to drive the machine at a high speed these points crumbled or broke because of the frequent impact of the member of the slider moving in these grooves against them.

It is argued in support of the patentability of this first group of claims that it enabled a machine to be driven at a very much more rapid rate than the machine of the patent and because of the case-hardening of the grooves very little lubrication was necessary and there was no spattering of oil against the yarn.

The question, however, is whether, when it was found that these points broke, was there any invention in making the points more resistant to breakage and especially any invention in making them more resistant by the conventional and well known process of case hardening.

The patent to Müller, No. 1,551,764 (R. p. 191), and the patent to Birkigt, No. 1,938,566 (R. p. 199) were cited as showing illustrations of the use of case-hardening. Specifically, the first patent shows a power transmission chain in which the bearing faces of the links have been case-hardened, and the second patent shows a piston and cylinder in which the contacting faces have been case-hardened. The specification of this latter patent states that because of the combination of the two case-hardened frictional surfaces high speed operation is permitted and friction and wear reduced.

On cross-examination, the inventor, Edward J. Abbott testified (R. pp. 47 and 48) that the cause of deterioration was due to the engagement of the points against the dog of the slider, that it was a matter of breaking rather than wear by surface contact and to avoid that breaking he decided to use a harder metal than cast iron. He further stated that case-hardening was at that time a well known process and "an ancient thing."

It is too well settled to need the citation of decisions but the mere fact that a second device is an improvement on what preceded it does not necessarily establish that the second device was patentable over the first.

The question here involved as to this group of claims is the one that has come up so often, namely, the question whether invention exists because of a change of material of which a thing is made.

This Court had occasion to consider that question comparatively recently in the case of *Pick et al.* v. *Coe, Commissioner of Patents,* ——— App. D. C. ———, 99 F. (2d) 985, 494 O. G. 718.

In that case the Court held invalid a claim for a rotary disk valve for a water-softening machine made of a laminated synthetic plastic. The court held that claim invalid because it appeared that a ball valve had been previously made of this material. This holding was made notwithstanding the fact that it appeared that this valve was extremely efficient and prevented leakage between the various pipes which were alternately brought into connection to provide the proper operation of the water softening machine.

In its decision the court said:

> * * * we cannot say that an art which knew the use of this material in valves for pumps required some uncommon talent to conceive of using it in valves for water-softeners.

The Court's attention is called to two decisions which in the opinion of the writer of this brief are extremely illuminative as to question here involved.

These two decisions were written by Judge Coxe, then Judge of the Circuit Court of the Southern District of New York and afterwards of the Court of Appeals of the Second Circuit.

These two decisions are, first, *Union Hardware Co.* v. *Selchow et al.*, 112 Fed. Rep. 1006, in which it was held that a sheet metal truck for roller skates was not patentable where such a truck had been previously made of cast metal. The other case is that of *George Frost Co. et al.* v. *Cohn et al.*, 112 Fed. Rep. 1009, in which a patent on a hose supporter having the button thereof surrounded by rubber was held patentable. The court pointed out why in its opinion the truck of the roller skate was not invention and why the device of the Frost case was patentable referring to the latter decision in the former.

Now, it is submitted that when the inventor found that the points on the cam cylinder where the grooves crossed tended to break on the impact of the slider and he realized that he must make these points of harder metal, it was not invention to use a case-hardening process for that purpose. In fact, it appears that at first the attempt was made merely to harden the points and later the case-hardening process was used.

It is respectively submitted that if there was no invention in the selection of the case-hardening process for producing a cam cylinder with less breakable points, it did not become invention because it was found that less lubrication was necessary, if it be a fact that it was not known at that time that less lubrication was necessary where a member was moved across a case-hardened surface than where it was moved over a cast iron surface.

The next group of claims relates to the slider. This slider is mounted upon a rod and has a cover plate to prevent the turning of the slider on the rod.

The patents to Foster, No. 459,039 (R. p. 81), Rhoades, 867,153 (R. p. 129), and the British patent to Jones, No. 108,407 (R. p. 186), each shows a cam in a winding machine provided with crossing grooves therein adapted to cause proper movement of the thread guide and each of the patents to Foster and Rhoades shows that slider element mounted on a round rod while the British patent to Voigt, No. 2102 (R. p. 184) shows in a winding machine a cover plate for supporting the slider.

The ground of rejection was that in view of this disclosure of the prior art there was no invention in mounting the slider, as shown in the Abbot application and as specified in claims 26 and 28.

It is submitted that in devising the specific form of mechanism shown in the Abbot application the applicant had done nothing more than follow the teachings of the art, making the appropriate mechanical changes. Certainly making such mechanical changes does not rise to the dignity of invention.

Claims 34, 35, and 36, relate to the tires on the cam roll. These tires rest upon the rotating roll and serve, with that roll, as a frictional drive for causing the revolution of the cam cylinder. The Abbot patent shows tires of soft metal for the same purpose in the same relation resting upon the driving roll.

In appellant's brief it is stated that there was no testimony offered by the defendant to show that the soft metal was resilient.

It is submitted that it is obvious on the face of it that such a soft metal tire would be resilient to a certain extent and it may be noted that plaintiff has not offered one word of evidence to indicate that that is not the fact. The Board of Appeals had so held and it was clearly incumbent upon plaintiff to establish, if such was a fact, that these soft metal tires had no resiliency.

It is submitted that the court below correctly found that claim 34, which merely defines the tire as resilient, is absolutely anticipated by the Abbott et al. patent.

It was held by the Patent Office and also by the court that there was no invention in substituting for the soft metal tires of the Abbott et al. patent a tire made of rubber, or substituting a tire made of cork. This holding is challenged primarily on the ground that these tires partake of two movements, namely, the lateral movement along the roll as the winding mechanism is carried longitudinally of the roll by the sprocket chain and, secondly, a rotary motion as the cam is caused to turn by the friction between the tire and the roll. It is argued that there is nothing to indicate that rubber or cork was especially desirable for this purpose, but it should be noted that the tires of the Abbott et al. patent had exactly the same motions and all that, so far as this record shows, has been done is to substitute a tire of possibly a more resilient material.

It is submitted, however, that the change from a material having resiliency to one for a somewhat greater resiliency, and especially to a material all of whose qualities were so well known, was not invention.

It is submitted that when it appeared that the tire of the Abbott et al. patent was not resilient enough then all that had been done was to supply the defect by a selection of a perfectly well known material of greater resiliency.

It is submitted that the decree of the lower court should be affirmed.

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February 1939.

U. S. GOVERNMENT PRINTING OFFICE: 1939